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HEATING & VENTILATING
AIR CONDITIONING

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FOR JUNE, 1937

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For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning.

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HEATING & VENTILATING is published monthly by The Industrial Press, Robert B. Luchars, President; Edgar A. Becker, Vice-President and Treasurer; Erik Oberg, Secretary. Published at 148 Lafayette Street, New York, N. Y. Western Office, 228 North La Salle Street, Chicago, Ill. Yearly subscription in United States and Mexico, $2.00; in Canada, $2.50; in all other countries, $3.00. Single copies, 30 cents. Member of Audit Bureau of Circulation and Associated Business Papers.

VOLUME 34 NUMBER 6

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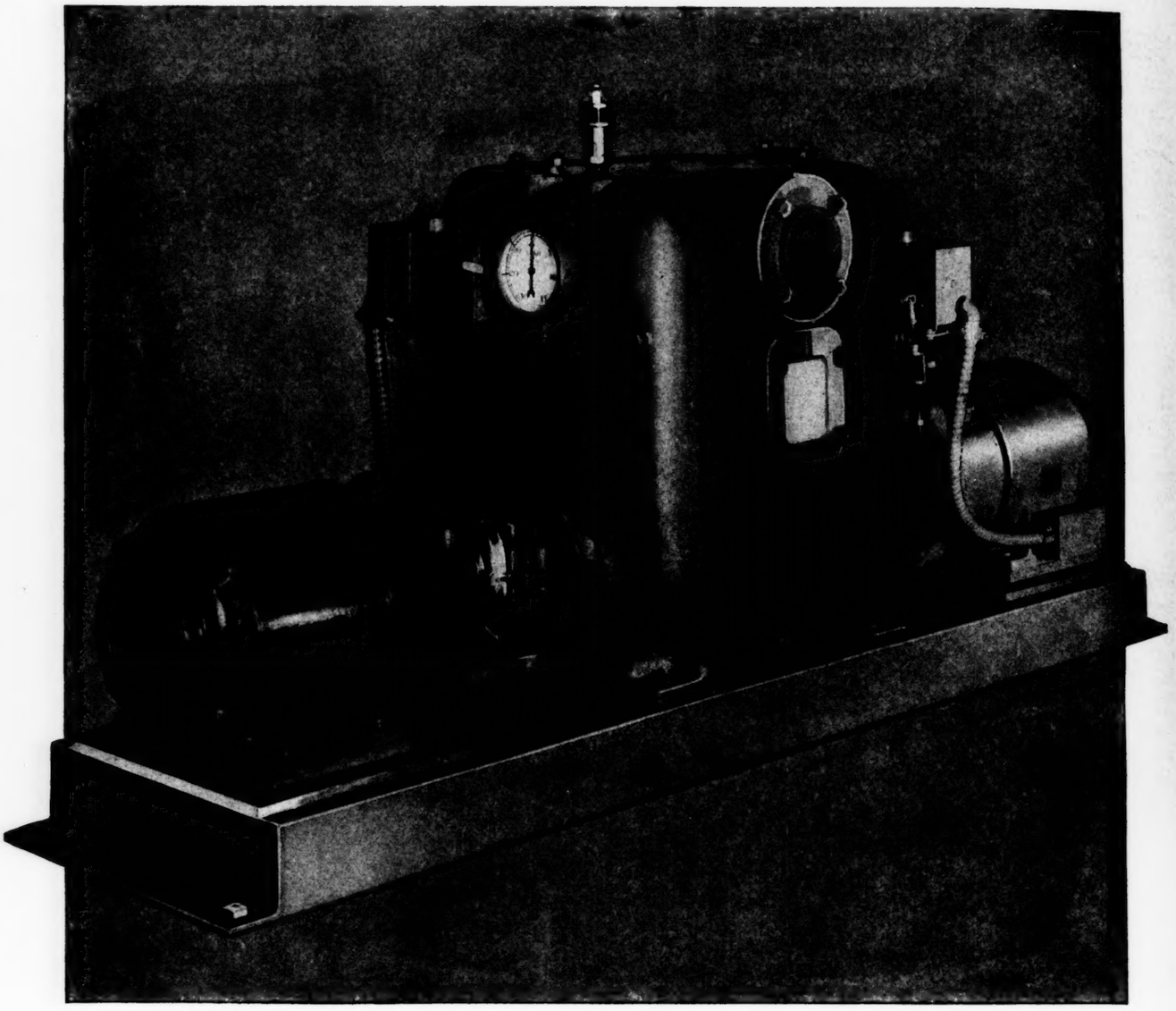

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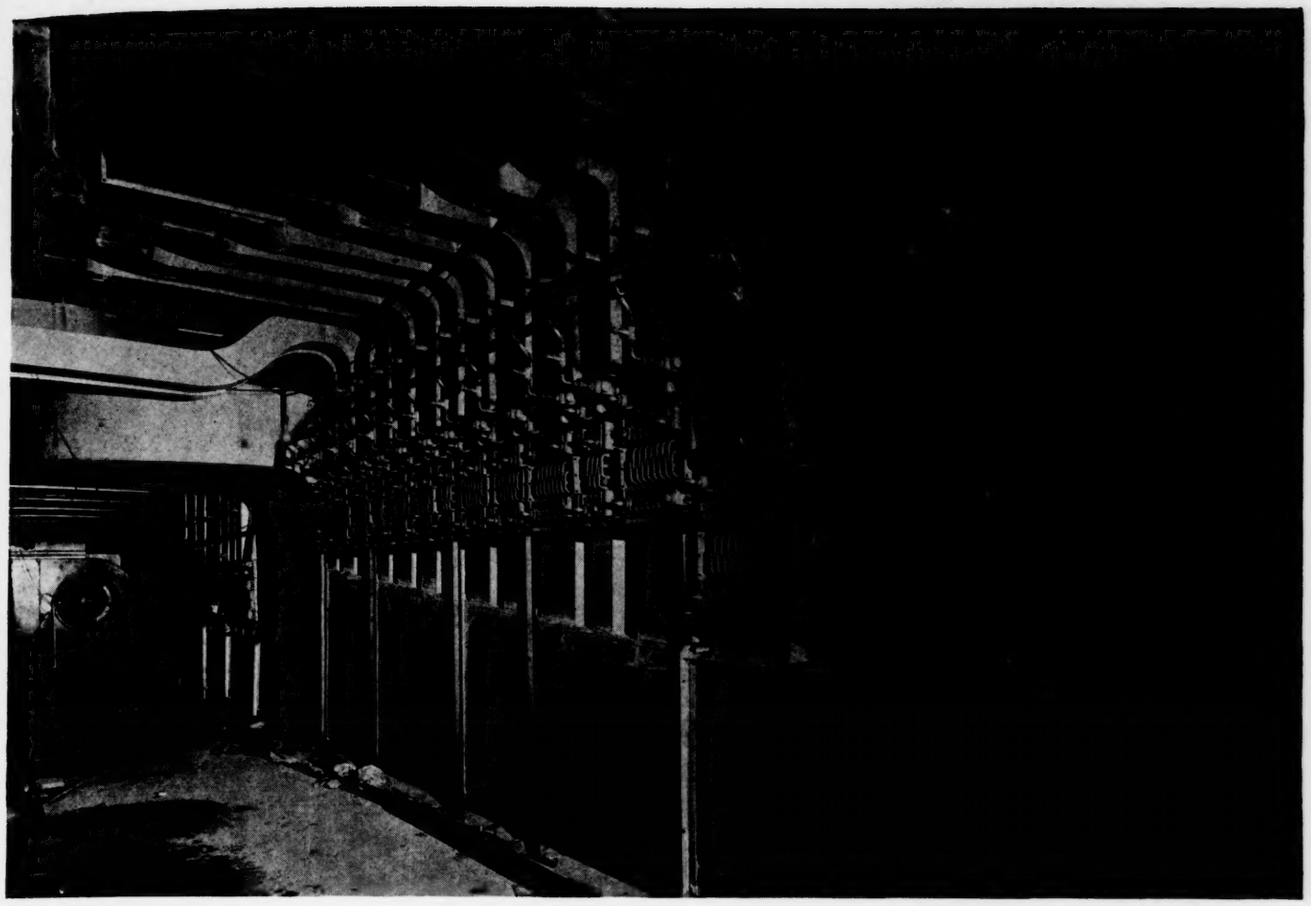


Fig. 1. Front view of system, showing blower, trunk line on ceiling, plenum chamber on floor, individual coils and risers to rooms above.

63 Individual Ducts Serve Air Conditioned Spaces in Windowless Building

By ROBERT E. HATTIS†

In planning its new office and laboratory building near Chicago, the National Aluminate Corporation was faced with a number of problems which were solved by building a windowless structure with year-round air conditioning and high intensity lighting. The author, who designed the air conditioning system, here outlines the problem and describes the features of the air conditioning system, two of which are outstanding in interest: the heat gains in some of the spaces even in the coldest weather exceeded the heat losses; the extraordinary amount of ductwork involved. Photos courtesy "Sheet Metal Worker."

IT is doubtful if any air conditioning system has ever been installed which has more ductwork per unit of space than the recently opened building of the National Aluminate Corporation in the industrial district at Clearing, near Chicago. This building contains general and private offices, research laboratories for chemical treatment of water, recreation rooms, cafeteria, and other necessary spaces for the headquarters of National Aluminate.

The Problem

The uses to which the building is put, together with its location and with consideration of Chicago's climate, led to the decision that the building would be windowless and completely air conditioned. The location of the building is not particularly attractive from the standpoint of view and the air is dusty, sometimes odorous, and there is almost always noise. Consequently, a windowless type construction had some desirable features in that it would shut out the view, noise, dust, and odors. The advantages of such a construction would be that there would be a saving in approximately 20% in building structure cost.

However, any decision involving a windowless building almost necessarily requires adoption of complete air conditioning. The great discomfort experienced by employes in summer, both in the laboratories and offices, and cool drafts in winter made the idea of

†Consulting Engineer, Chicago.

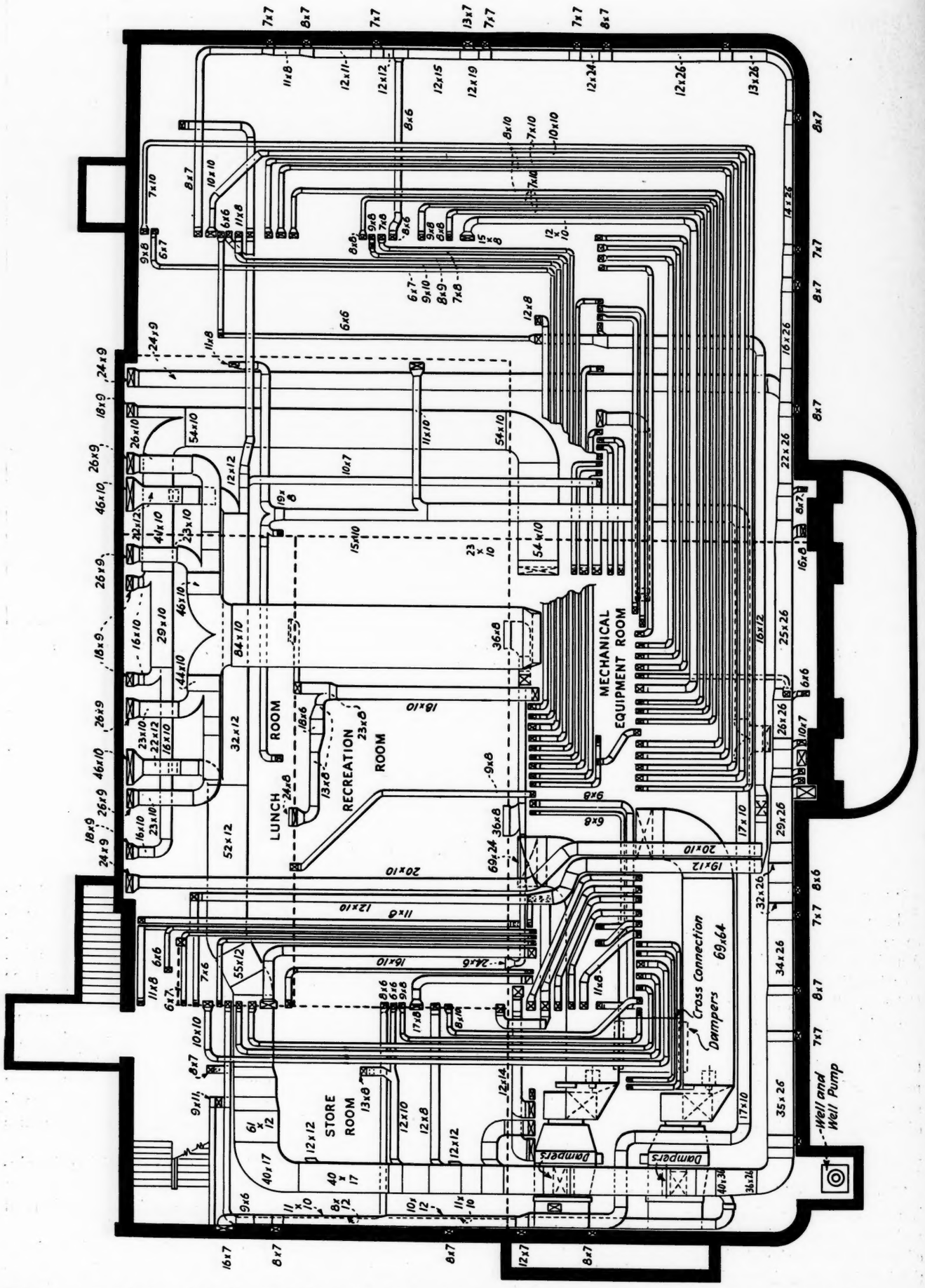
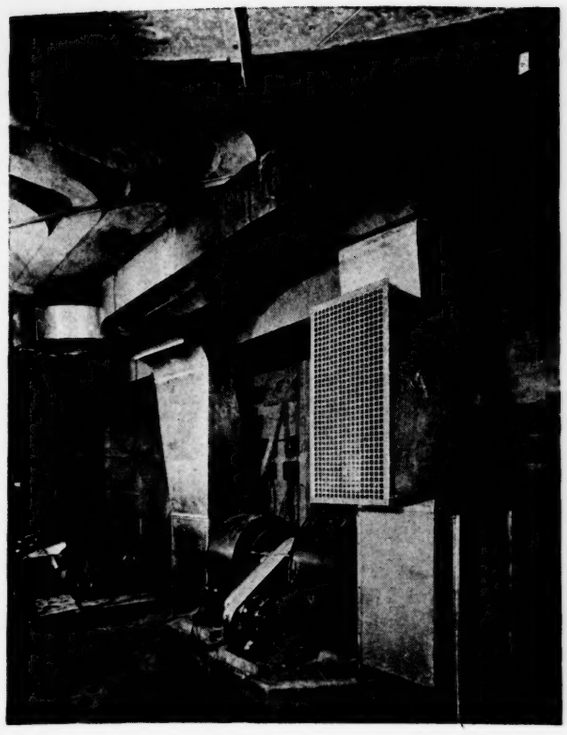


Fig. 2. Basement plan of the National Aluminate Corporation building showing the great amount of ductwork. Division of the basement into spaces for various uses is indicated by the dashed lines.



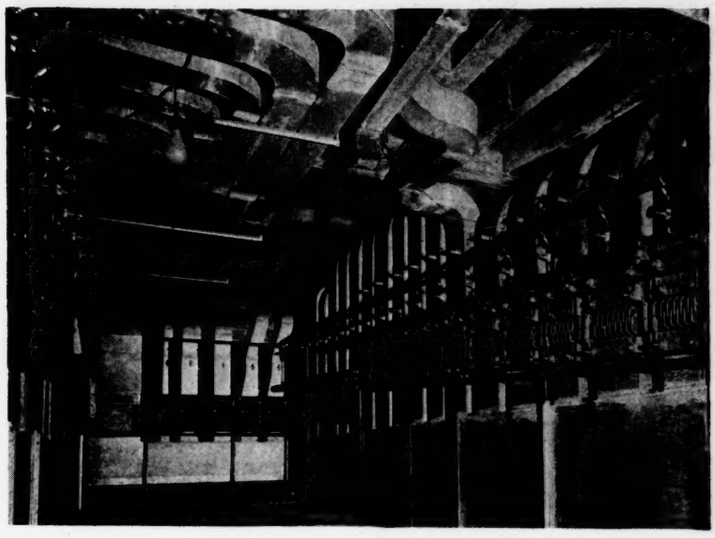


Fig. 3. (Left) Fan units for two exhaust systems in basement. Ducts on left made of terne plate to resist fumes. Both units rest on 6 in. concrete with 2 in. of cork on floor. Fig. 4. (Below) Looking in the opposite direction of Fig. 1 showing other side of aisle. All of this work was insulated with rockwool and cork.

air conditioning attractive in itself. If there were no windows, the summer cooling load would be greatly decreased and humidification in winter would be facilitated.

The obvious purpose of windows is to provide light but under present-day standards natural light has some disadvantages in that it is not uniform in intensity, whereas artificial lighting can be made so. In this particular building, with a large staff of engineers doing close work, artificial lighting and air conditioning were considered to be advantageous in themselves. When natural lighting is used there must be a considerable amount of space given over to courts, light shafts, and similar spaces, resulting in a costly wall surface. If artificial lighting is used there is a high heat load from the artificial lights in the summer. On the other hand, in the winter the artificial lighting load aids in heating the building.

Building Structure

Considering all these points the idea of erecting a windowless air conditioned building seemed desirable. The building construction selected was of white terra cotta walls with decorative bands and entrance. The walls consist of 15 in. of masonry with 2 in. furring strips and metal lath and plaster. The roof is of concrete joist construction with 2½ in. of concrete between the joists, 2 in. of cork board and tar and gravel roofing. The building is two stories in height, 135 ft. wide and 100 ft. deep.

Indirect lighting was selected with a light intensity of 20-ft. candles or more.

Heat Gains and Losses

The heat gain from the lights with this high intensity lighting system amounted to 67,300 B.t.u. per hr. for the general laboratory on the first floor, whereas the heat loss for this space in —10F weather totals only 18,705 B.t.u. per hr., indicating a fairly heavy cooling load even in the coldest weather in the winter. Similarly, the sum of the heat gains from the lights in the general office on the top floor is 45,600 B.t.u. per hr. as compared with a heat loss at design winter temperature of 32,210 B.t.u. per hr. A typical top floor office has a heat gain from light of 4600 B.t.u. per hr. against a heat loss of 3900 B.t.u. per hr.

The office portion of the building contains a large general office and numerous small offices. One of the requirements of the air conditioning system was that air of different temperatures could be supplied to the individual spaces depending on the requirements of the occupants of the different offices. These small offices are not always occupied and, since the lighting load is so high, alternate heating and cooling may be necessary. The spaces on the interior of the building with very low heat losses always require cooling. Therefore the air conditioning system had to be so designed that cool air could be provided for one space while an adjacent space might be drawing a supply of warm air. An additional problem was the exhaust of fumes from the chemical laboratories.

Distribution System

The accompanying drawing shows how the problem was met. Two similar air conditioning systems were designed, each serving about half of the building; one system can be cooling while the other is heating. Part outside air or all or none can be used, this air being tempered by coils in the basement. Recirculated air is cleaned by automatic oil filters and humidified in winter and then distributed to the conditioned spaces through a separate duct for each space, as shown in the drawing. In each of these individual ducts are cooling coils and heating coils.

Air enters the air conditioned space at or near the ceiling, taken out for recirculation from grilles at the floor and returned to the machinery room through insulated ducts. The excess of air supply over recirculated air is vented to furred corridor ceiling spaces and then exhausted through roof ventilators, except in the case of laboratories which have the vents connected by ducts to roof ventilators.

Cooling

Well water at 53F was available for cooling and the cooling load, which totals 90 tons, is handled by two 10-hp. pumps. On the basis of electrical consumption for the pumps, which is the only cost of the cooling, the 90-ton cooling job at maximum load conditions will cost 34c per hr.

Two wells, each about 300 ft. deep, supply the water. From the pump the water passes through cooling coils, the supply being controlled by a throttling valve and turn control by thermostat in the conditioned space. The outlet from the coils passes through the sewer. Counterflow of the water is employed in the coils and a 20F rise in cooling water temperature is obtained.

The heating coils use hot water as the medium, the hot water being provided by a heat exchanger with steam in the shell and water in copper coils inside. Steam is provided to the exchanger at such a rate as to maintain a water temperature of 200F, controlled by a throttling valve in the steam supply line.

Since there are 63 individual conditioned spaces in the building it is necessary to have this many individual cooling and heating coils in the ducts. When the conditioned space is cooled by the temperature setting of the thermostat the heating valve opens, allowing hot water to flow through the coils, and when the room is brought up to the desired temperature the valve remains in a throttled condition depending on the heat requirements. The heating valve closes when the room temperature rises above the desired setting and if it remains above, the cooling valve is opened gradually to lower the temperature.

The architect was Ambrose C. Cramer, Inc., Chicago. The ductwork and ventilating work was handled by the Narowetz Heating & Ventilating Co., while the steamfitting was done by the Modern Plumbing & Heating Co. Both of the contractors are Chicago firms.

Explosions in Heating Plants May Be Reduced by Proper Firing

HOUSEHOLDERS who experience irritation because of explosions in their heating furnaces and boilers may largely eliminate such explosions by the use of proper firing methods, says the U. S. Bureau of Mines, Department of the Interior. Careful regulation of the air supply is the solution.

Explosions in domestic heaters are of fairly common occurrence. As a general rule, such explosions are not serious and do no damage. They may, however, be severe enough to blow the flue pipe apart; the more common occurrence is the blowing open of the doors. They are particularly disagreeable when occurring in warm-air furnaces in which the joints are not tight, as the smoke and fumes are forced into the air ducts, and thus to the rooms of the house.

Such explosions usually occur shortly after firing a charge of fuel. The sequence of events is that the fresh fuel smothers the live fuel and extinguishes the flame; as the fresh fuel is heated, combustible gases are driven off, and if the amount of these gases is greater than the air from the ashpit can burn, then unconsumed gases will pass out of the fuel bed and mix with the air entering through the slots of the firing door, but because there is no flame, the gases will not burn and will pass to the stack; after a time, however, the flame will work through the bed of fresh fuel and ignite the gases. Whether or not an explosion occurs will depend on the proportion of gas and air in the combustion space, and its temperature. Mixtures which have a large excess of air, or even a large deficiency of air, do not explode.

Explosions are not limited to bituminous fuels which give off quantities of gas when heated, but may occur with anthracites or even cokes. With these fuels, explosions are more likely as the size of the fuel is smaller, because small sizes form more carbon monoxide. Investigations at the Pittsburgh Station of the U. S. Bureau of Mines have shown that for each of these and other non-caking fuels, no explosion can occur if the size of the fuel be greater than some minimum; with sizes below this minimum, the possibility of explosions increases with decrease in size. An insufficiency of the air supply through the door slots may cause an explosion at times other than those shortly after firing. The combustion chamber may contain an excess of combustible gases and these may be too far from the flame to burn with such air as they contain; at some period the mixture may become such that it is within the explosive range, and be suddenly fired by the distant flame. Such an occurrence is more likely in larger furnaces at low rates of burning. A puff of flame when opening the firing door is an evidence of its possibility, and indicates that the door slots should be opened wider.

The first precaution against explosions when firing is to leave always a part of the live fuel exposed, if necessary pushing some of the live fuel back in order to raise its level. The second is to insure an ample supply of air above the fuel bed, even leaving the firing door open a crack, if opening the slots does not eliminate explosions. The adjustment of the dampers to insure this air supply will differ with heaters and fuels, but the supply of air above the fuel bed can be increased by leaving ashpit damper closed, or nearly so, and regulating rate of burning by the dampers in the stack.

AIR POLLUTION

A Study of Air Pollution in New York City

Air pollution is a subject of prime importance to heating and air conditioning engineers for two good reasons: first, fuel burning heating equipment is responsible for at least a portion of the undesirable substances which clutter up the air in urban districts; second, because air conditioning is probably necessary to remove these and other perhaps still more undesirable substances from the air in order to make the air fit to breathe. It is noteworthy that we are all concerned about the quality of the 5 1/2 lb. of food and water we consume daily but little attention is given to the 25 lb. of air we breathe during the same period.

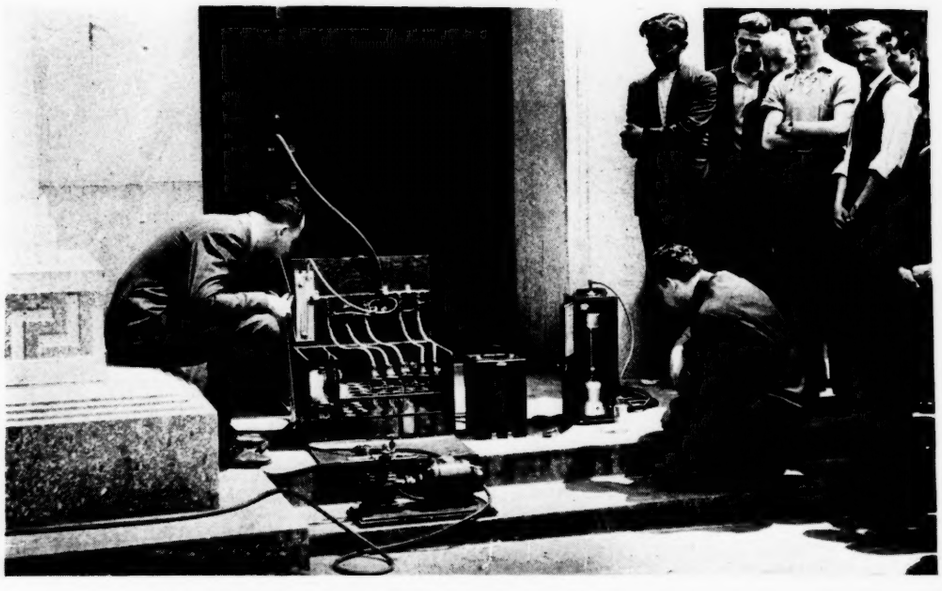
The exhibits shown on the following seven pages are from a survey made in New York City under the city's health department, using WPA men and money. Results of this survey were reported in "A Study of Air Pollution in New York City" by Sol Pincus and A. C. Stern presented in a paper before the public health engineering section of the American Public Health Association at its annual meeting last fall, and published in the Association's American Journal of Public Health.

PHOTOS

COURTESY OF WPA ART SERVICE PROJECT

(Above) Biological workers in the laboratory of the Woman's Hospital where some of the studies relating to bacteria were made.

(Below) A view in one of the laboratories where analyses were made for the air pollution survey.



(Right) Determining the dust count in the air in one of the numerous tests made in the survey.

(Left) Taking air samples in a schoolroom on Manhattan's west side.

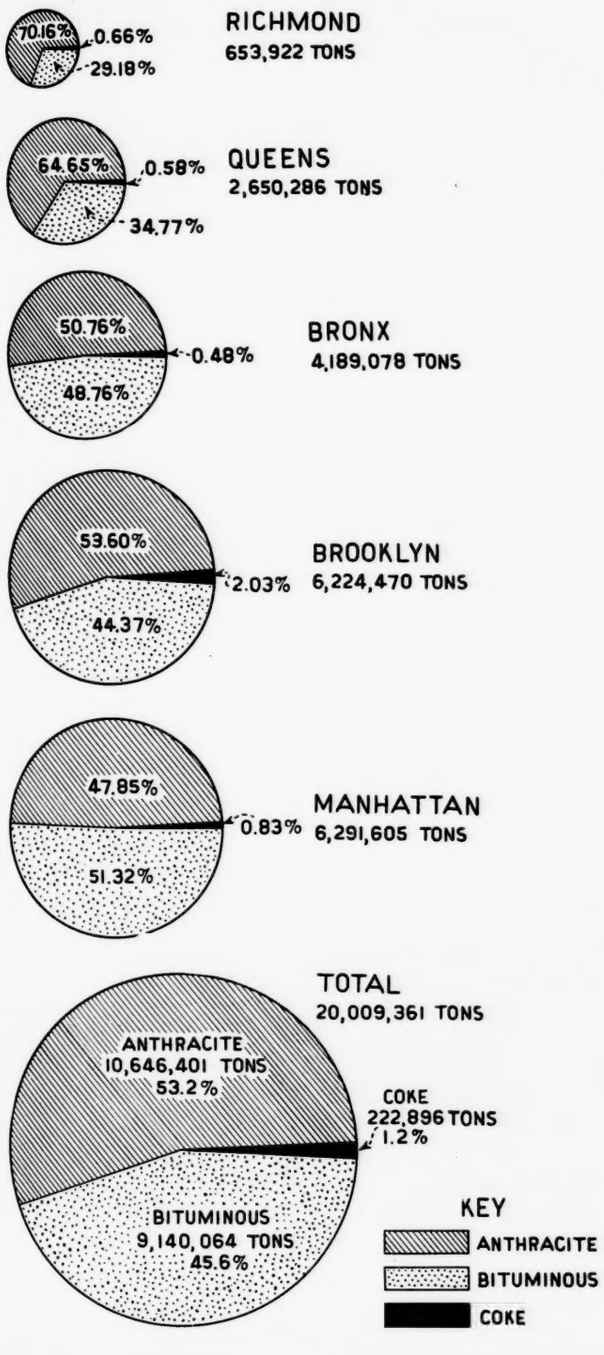
FUEL

IN NEW YORK CITY

OIL

BOROUGH	QUANTITY, Gallons	DOMESTIC, Per cent	INDUSTRIAL, Per cent
Manhattan	164,800,000	30.6	69.4
Brooklyn	187,400,000	38.6	61.4
Bronx	120,000,000	34.3	65.7
Queens	113,890,000	22.9	77.1
Richmond	13,910,000	54.3	45.7
Total	600,000,000	32.9	67.1

COAL



APPROXIMATELY 5% of all the coal consumed in the United States is burned within the 309 square miles comprising New York City. Twenty per cent of the nation's anthracite is consumed in this territory. The bulk of the soft coal is burned by the public utilities. During a typical year, excluding automobiles, these various fuel-burning units poured into the air 300,000 tons of soot, tar, cinders and fly ash together with 350,000 tons of sulphur in an oxidized form which probably results in about 1,000,000 tons of sulphuric acid.

In contrast with other large cities locomotive smoke in New York City is of relatively minor importance since most railroads are electrified or use diesel engines in this area. Yet to be surveyed are the few coal-burning locomotives which do operate in New York, plus open dump fires, steam rollers, steam shovels, cranes, and tar kettles.

The table above shows the quantities of oil used in the different boroughs of New York City together with a breakdown into use, whether domestic or industrial, by quantities. The chart to the left shows the distribution of coal in New York City by boroughs and also by type — anthracite, bituminous or coke.

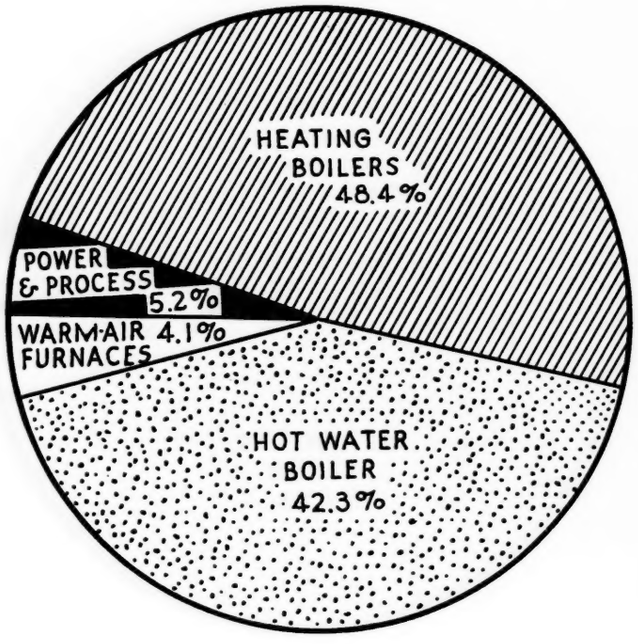
All of the figures relate to the year 1934.

FUEL

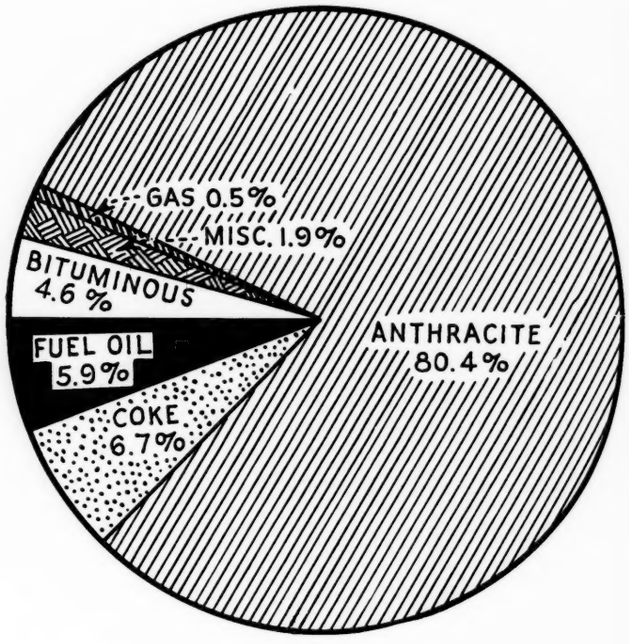
IN MANHATTAN

An analysis of 76,390 fuel-burning units in one of New York's five boroughs, covering the years 1935-36. Note that this is a study of number of units, not of volume of fuel consumed. This analysis of Manhattan's fuel-burning units is made because that borough consumes 31% of the total fuel burned in the whole city. Further, figures could be obtained in greater detail in this borough than in any other. Access was obtained to over 95% of Manhattan's premises and of these 66% had fuel-burning equipment which were potential producers of smoke and in these premises were found the 76,390 units referred to above.

PURPOSE



FUEL BURNER



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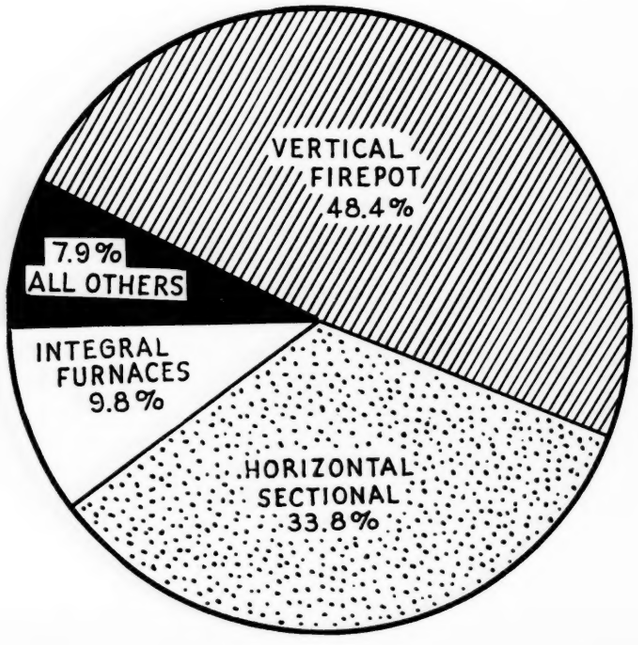

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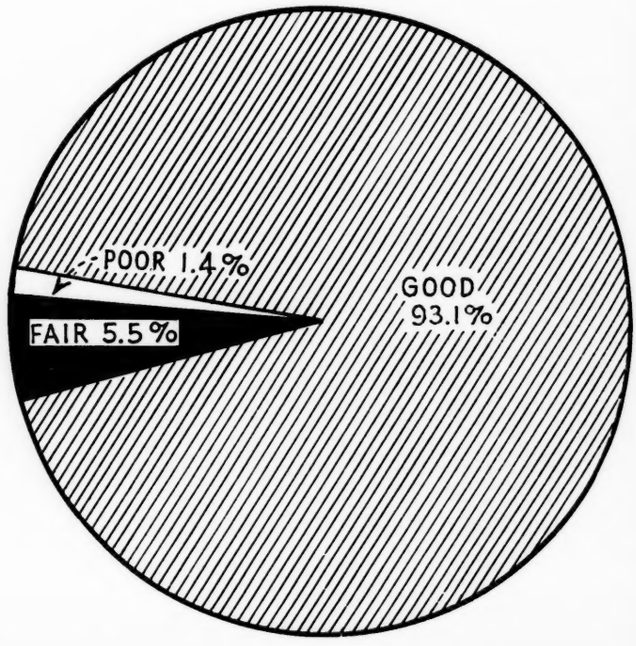


SOOT

COUPLED with the burning of fuel and the production of smoke is the production of cinders, fly ash, soot, and tarry particles emitted from chimneys. This material eventually settles out of the air on to the earth's surface. The larger particles settle directly due to their own weight; the smaller float for a considerable distance but eventually either settle out due to their own weight, be washed out by rain or snow, or flocculate to form larger particles that then settle or are washed out of the air. It is thus obvious that prevailing wind direction and velocity will have a very large effect in determining when and where these particles will settle but that the principal factor in the distribution of particle settlement will be when and where these particles are produced. It is thus possible to ascertain the general direction of the sources of particulate matter by determining where it settles and what sort of wind carried it to the point of settlement. In addition to the value of tracing pollution to its source, it is of interest to know the actual distribution of settled matter in so far as it visibly represents the dirtiness caused by air pollution. This settled matter, the so-called "soot-fall," is the cinder that gets in one's eye, the dirt that settles on the roof and the street and on the floor in one's home. It includes the tarry matter that dirties windows, building walls, vegetation, and clothing, and the soluble particulate matter dissolved and precipitated by the rain. There obviously must be a close relationship of the quantity and character of this sort of emission to the smoke that originally accompanied a large part of it, and the fuel from which it was produced.

Soot-fall was collected in copper cans 5 in. in diameter and 8 in. deep exposed for a month on flat roofs of one- and two-story buildings, and is reported in terms of tons of settled matter per square mile per month. An average of 130 such cans were exposed in all five boroughs each month and their contents analyzed in the Chemical Laboratory for two fractions, insoluble and soluble. The insoluble fraction is further divided into insoluble solid matter, ash, combustible matter, and tar (carbon disulphide soluble matter). The soluble fraction was broken down into soluble solids, SO_3, NH_3, and Cl (as NaCl) and ash. Control stations were used in Westchester and Long Island. These cans collect, as well, settled matter of non-fuel burning origin, such as plant matter, salt from sea spray, and inorganic atmospheric dusts from numerous sources. However, the percentages of soluble matter, combustible matter, tar, SO_3, NH_3 and Cl serve as good indicators of the source of the greater part of the settled matter in each gauge.

Samples of the equipment used in a large number of locations for collecting dust and soot samples.

TONS OF SOOT-FALL PER SQUARE MILE PER MONTH IN VARIOUS SECTIONS OF NEW YORK CITY

(Figures are for April, 1936)

	Insoluble Matter	Soluble Matter
Industrial	314.3	44.1
Commercial	153.8	30.3
Slum	332.8	35.7
Harbor	250.4	28.6
River	120.9	24.6
Residential (Apts.)	75.5	20.8
Residential (Houses)	48.4	5.2
Suburban	12.5	25.2

BACTERIA

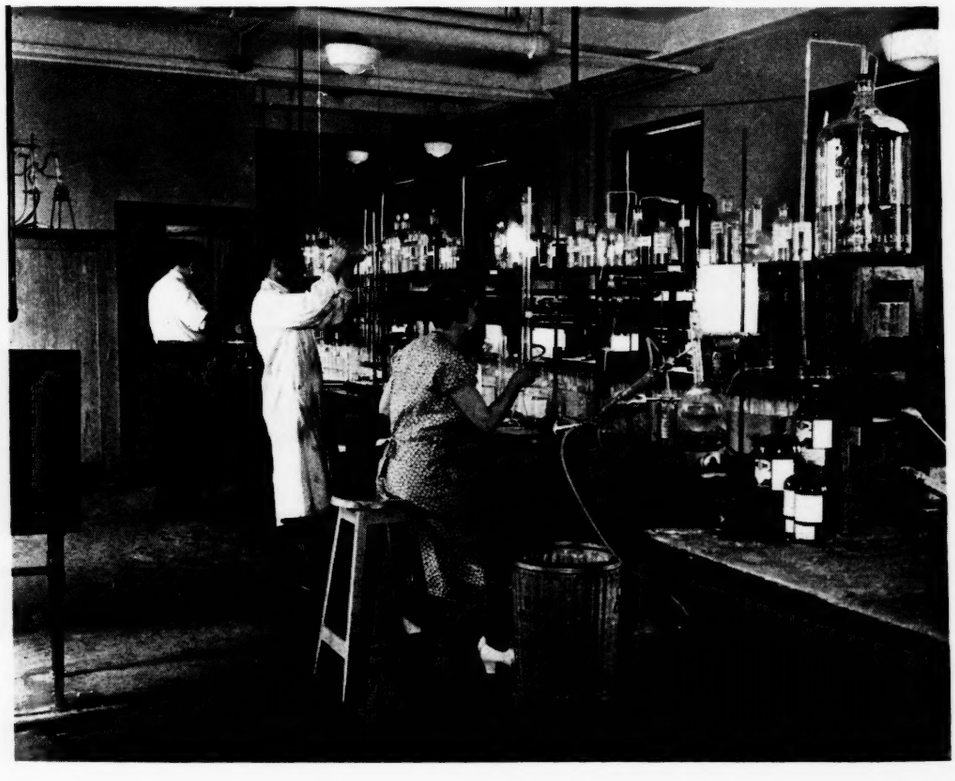
Numerous studies of bacteria in air were made during the nineteenth century with results of negligible significance. Improved technique and equipment have stimulated studies of air pollution, and a recently developed method permits counting of bacteria when incubated in the same bottle as originally used for collecting air samples, thus doing away with previous cumbersome complications.

The objectives in this particular study were to obtain a composite picture of number and kind of bacteria in the air of various places of assembly and to determine if possible the degree of relationship of these figures with public health. The table below shows the number of streptococci per cubic foot of air in the city at various locations. These samples were taken during a 16-week period from January 23 to May 15, 1936, and the total number of samples was over a thousand. It is of interest that approximately 90% of the alpha hemolytic streptococci from schools and subways here are organs whose normal habitat presumably is the human naso-pharynx. Additional data on bacteria count are presented on the opposite page.

STREPTOCOCCI PER CUBIC FOOT OF AIR IN NEW YORK CITY AT VARIOUS LOCATIONS

(16-Week Period—January 23 to May 15, 1936)

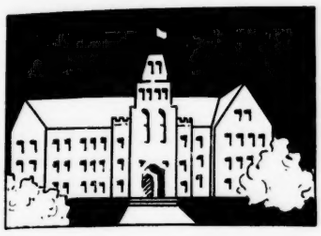
Location	All Streptococci	Beta Hemolytic Streptococci	Alpha Hemolytic Streptococci	Pneumococci
Schools	0.30	0.01	0.18	0.01
Subway	0.10	0.0003	0.085	0.015
Theaters—Not ventilated	0.04	0.001	0.038	0.001
Theaters—Ventilated	0.03	0.0005	0.026	0.003
Streets	0.05	0.0001	0.045	0.004



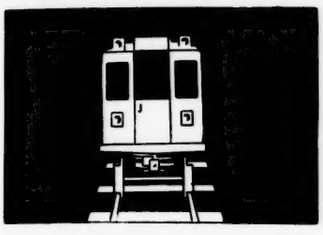
BACTERIA

The chart below shows the number of bacteria per cubic foot of air in New York City at various locations incubated 18 hours at 37C collected during the period from January 10 to June 26, 1936. The chart is based on an average of the counts incubated by the two different methods. The figures are interesting in that they show the startling difference in the relative bacteria count in the air in different places of assembly. It is especially interesting to note the improvement in number of bacteria in ventilated theaters as compared with non-ventilated and to see how favorably ventilated theater air compares with that of parks.

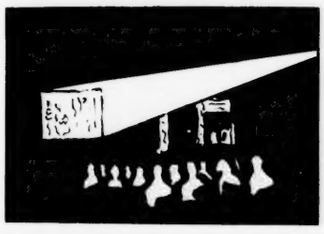
BACTERIA PER CUBIC FOOT OF AIR IN VARIOUS PLACES OF ASSEMBLY



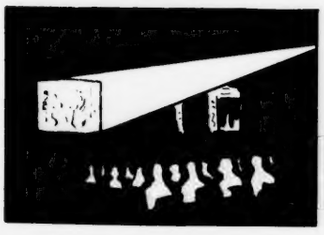
SCHOOLS



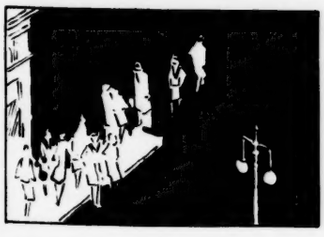
SUBWAYS



THEATRES (UNVENTILATED)



THEATRES (VENTILATED)



STREETS

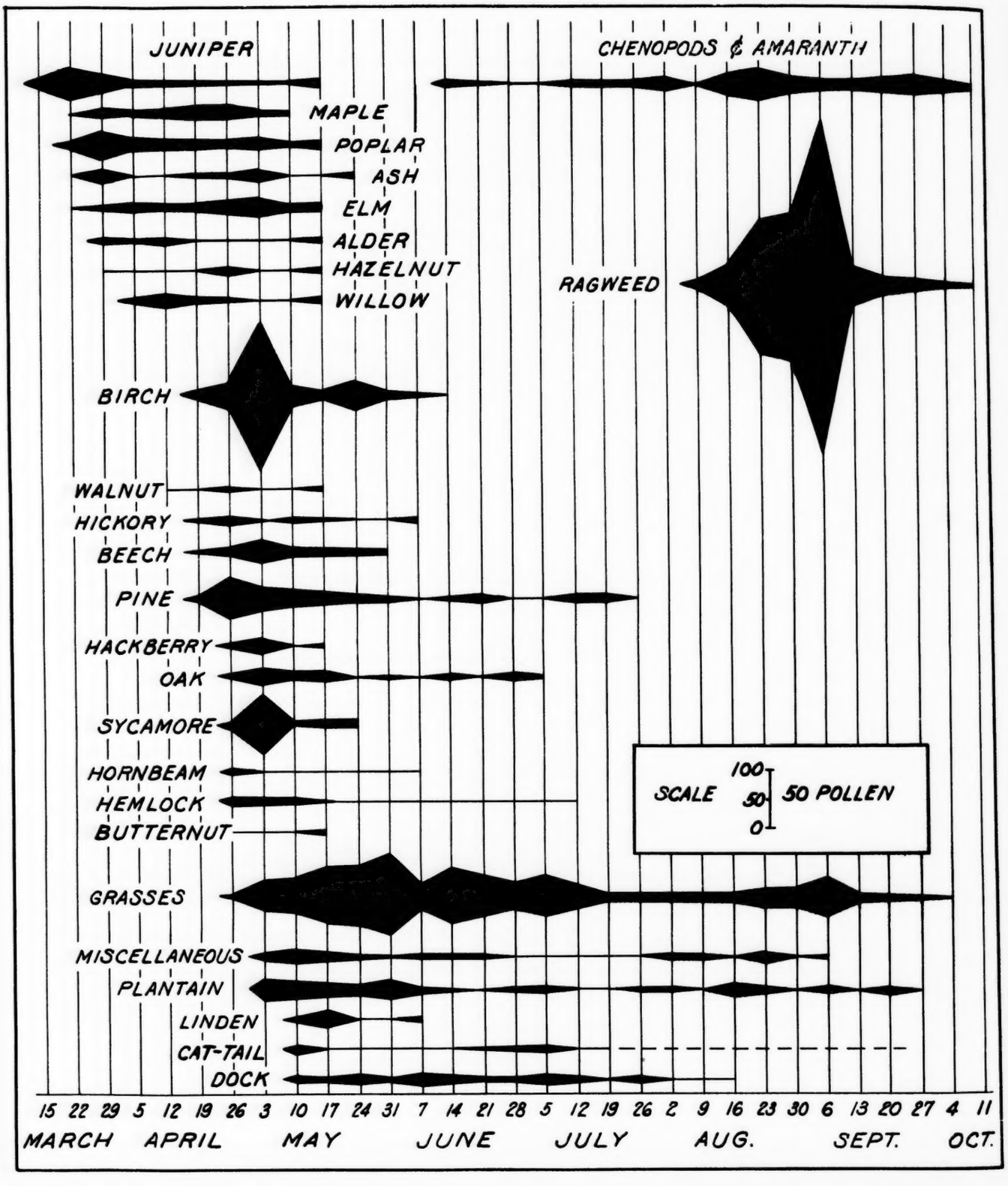
PARKS

Each skull represents
2 bacteria per cubic foot of air

POLLEN

The chart below shows the pollen count in nine different locations in New York City during the pollen season from March to October. The count is arbitrary to the extent that it did not propose to determine the number of pollen per unit of volume of air but merely the relative number falling on one slide as compared with the number falling on a similar exposed slide in some other location and some other time. The chart shows clearly the importance of ragweed pollen.

SEASONAL VARIATION OF VARIOUS POLLEN IN NEW YORK



Technical Groups Formulate Air Conditioning Code Recommended for Wisconsin

Another forward step in air conditioning has been made in the framing of the Air Conditioning Code recommended for use in the State of Wisconsin and issued late in March. The code, sponsored by a number of technical organizations, ties in with Wisconsin State Code intended for winter heating and for ventilation. This new code contains so much specific information in clear and condensed form that it is reprinted here practically in full

THE State of Wisconsin has long been outstanding in having one of the most complete and workable codes for winter heating and ventilation of any state in the Union. Recent developments have made it desirable to have some sort of standards for summer air conditioning and consequently seven organizations banded together to prepare what is entitled "An Air-Conditioning Code Recommended for Use in the State of Wisconsin."

Each of the interested organizations was represented on the Committee by at least one man. The members of this Committee together with the organizations they represent are: E. Szekeley, ASHVE, chairman; C. H. Randolph, Wisconsin Utilities Association, vice-chairman; E. F. Vilter, secretary; E. Baars, American Society of Refrigerating Engineers; A. C. Eschweiler, State Association of Wisconsin Architects; J. S. Jung, Heating, Piping and Air Conditioning Contractors Milwaukee Association; W. J. Kampman, Wisconsin Master Refrigeration Contractors' Association; A. Luedecke, ASRE; C. W. Miller, ASHVE; B. Nordberg, Engineers' Society of Milwaukee; H. Sloan, ESM; and J. H. Volk, HPACCMA.

The Code with a few minor typographical changes and rearrangements follows in full:

Scope and Purpose

This code purports to outline minimum requirements for comfort air conditioning, thus bringing about a uniformity of procedure which in turn will create sounder engineering, uniform trade practice and protection of interest of the buyer by furnishing a proper basis for comparison. As the minimum demand is largely based on needs of comfort and health, an engineering code, such as this, should eventually be helpful in drafting state codes or local ordinances.

Definitions

Application Engineering Standards for air conditioning are those relating to conditions and factors which form the basis of design load estimating and specifications of performance. These are distinct from standards of apparatus design, of installation practices, trade practices and of safety.

The Design Load is the capacity required of the apparatus to maintain specified conditions inside when specified code conditions of temperature and humidity exist outside and when all sources of loads are taken at the maximum that will occur coincidently.

A Summer Air Conditioner is a specific air treating combination consisting of means for ventilation, air cleaning, air circulation, cooling and dehumidifying with control means for maintaining room temperature and humidity within prescribed limits.

A Winter Air Conditioner is a specific air treating combination consisting of means for ventilation, air cleaning, air circulation, heating and humidifying with control means for maintaining room temperature and humidity within the prescribed limits.

Relief Cooling. Any system which is not capable of maintaining conditions prescribed in this code at all times cannot be designated as an air conditioning system but should be referred to as a relief cooling system if there is equipment which can reduce temperature and absolute humidity to some extent.

Design Load Factors

The following factors must be included in the load calculation and the first eight shall be specifically stated by the owner as the basis of guarantee.

Design outside conditions.

TABLE 1—INFILTRATION IN COMMERCIAL ESTABLISHMENTS IN SUMMER

REVOLVING AND SWINGING DOORS OPENING TO OUTSIDE		
Application	Infiltration C.f.m. per Person in Room	
	72 In. Revolving Door	36 In. Swinging Door
Bank	6.6	8.0
Barber shop	4.0	5.0
Broker's office	5.5	7.0
Candy and soda	5.5	7.0
Cigar store	20.0	30.0
Department store (small)	6.5	8.0
Dress shop	2.0	2.5
Drug store	5.5	7.0
Furrier	2.0	2.5
Hospital room	...	3.5
Lunch room	4.0	5.0
Men's shop	2.7	3.7
Office (private)	...	2.5
Office (professional)	...	3.5
Restaurant	2.0	2.5
Shoe store	2.7	3.5
WHEN DOORS ARE LEFT OPEN CONTINUOUSLY		
72 in. revolving door (panels open)	1200 c.f.m.	
36 in. swinging door (standing open)	800 c.f.m.	

Note: These values for swinging doors and for doors left open hold only where such doors are in one wall only, or where the doors in other walls are of the revolving type. If swinging doors are used for access, or doors are left open, in more than one wall, the infiltration cannot be estimated. The values for revolving doors hold regardless of number or location.

To determine the total C.f.m. infiltration due to opening of doors multiply the design number of occupants by the factor from the above table for the kind of establishment in question. When there is more than one door, treat them as though there were only one, except in case of open door.

TABLE 2—INFILTRATION THROUGH CRACKS AROUND WINDOWS

Type of Window	Remarks	C.f.m. per Ft. of Crack (Wind Velocity 10 Miles per Hr.)		C.f.m. per Sq. Ft. of Entire Sash Area (Wind Velocity 10 Miles per Hr.)	
		Single Window	Double Window or Storm Sash	Single Small	Large
Double Hung Wood, Sash Windows (Unlocked)	Average window not weather-stripped	0.36	0.28	0.46	0.29
	Average window weatherstripped	0.27	0.20	0.34	0.22
	Poorly fitted window not weatherstripped	1.16	0.85	1.50	0.93
	Poorly fitted window weatherstripped	0.33	0.27	0.42	0.27
Double hung Metal Windows, (Unlocked)	Not weather-stripped	0.78	0.60	1.00	0.62
	Weatherstripped	0.33	0.27	0.42	0.27
Single Sash Metal Windows	Hollow metal vertically pivoted	1.75	1.48	—	—
	Residential casement	0.55	0.40	—	—

Infiltration through door cracks may be assumed to be twice that of window cracks. Small windows are approximately 30 in. x 72 in.; large windows are approximately 54 in. x 96 in.

Design inside conditions.

Number of occupants.

Classification of installations as to "AA," "A" or "B".

Internal sources of load such as illumination, power appliances, sources of moisture, etc.

Time of day (for peak load determination).

Class of activity of occupants.

C.f.m. of outside air for ventilation.

Transmission losses through walls, windows, etc.

Sun heating effect.

Infiltration. Proper allowance for infiltration should be made in accordance with Tables 1 and 2.

Design Outside Conditions

Winter Air Conditioning. Data to be used as incorporated in Wisconsin Code, Order No. 5822.

Summer Air Conditioning. For summer air conditioning outside exposure of 95F dry bulb and 75F wet bulb shall be used, but for purposes of guarantee, the load also should be calculated for 85F dry bulb and 73F wet bulb with corresponding inside design conditions as specified in the next paragraph.

TABLE 3—MAXIMUM ALLOWABLE TEMPERATURES TO BE MAINTAINED INSIDE FOR GIVEN OUTSIDE CONDITIONS

Outside		Inside, Class AA,* Occupancy Over 40 Minutes		Inside, Class A,* Occupancy Over 40 Minutes		Inside, Class B, Occupancy Brief	
Dry and Wet Bulb Temperatures, F.							
Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb
95	75	78	65	80	67	82	68
85	73	75	64	76	65	78	68

*Class AA differs from Class A in that in the former the comfort of the permanent occupant is at least as important as that of the transient.

Design Inside Conditions

Winter Air Conditioning. Temperature to be maintained in occupied space is in accordance with Wisconsin Code Page 15, Order 5824 The inside relative humidity shall be 35% with outside temperature of 30F.

Summer Air Conditioning. For summer air conditioning the corresponding values of Table 3 are to govern and the capacity of the installation shall be such that specified indoor dry bulb temperature shall be maintained with a wet bulb temperature not exceeding values given in table when corresponding dry bulb and wet bulb temperatures prevail outdoors.

Ventilation Requirements

The minimum outside air introduced shall be not less than that specified by the Wisconsin State Code. Following quantities are recommended.

TABLE 4—MINIMUM OUTSIDE AIR QUANTITIES RECOMMENDED.

Application	C.f.m. per Person Recommended	
	Using Filters	Using Commercial Air Washer*
Apartments	15	10
Banking Space	10	10
Barber Shop	10	10
Beauty Shop	10	10
Brokerage	30	20
Cocktail Bar	20	15
Department Store	10	10
Directors' Room	30	25
Funeral Room	10	10
Hospital Rooms	15	10
Hotel, General	15	10
Office, General	15	10
Office, Private	30	20
Restaurant	15	10
Shop, Retail	10	10
Theatre	10	10
*General Application		
Each person, not smoking	10	10
Each person, smoking	30	25

Air Circulation and Distribution

The quantity and temperature of the treated air and the method of introducing it to the conditioned space shall be designed to limit to 3F or less, the variation in dry bulb temperature at the same level, and shall limit the variation in dry bulb temperature on any vertical line to 4F or less throughout the zone of occupancy.

Exceptions must be made in winter conditioning if space is located above unheated rooms, where the 4F vertical gradient cannot be held.

It is desirable to avoid air velocities exceeding 50 lineal feet per minute in the zone of occupancy. The zone of occupancy is considered the space between the floor and the 6 foot level, but no point nearer than 15 in. to a wall included. Exceptions must be made of the 3 feet vicinity of a supply grille and 2 feet vicinity of a return grille when construction necessity requires them to be located below the seven foot level.

Duct Capacity

It is desirable that return ducts be sized large enough to handle 100% of the circulated air to permit economical heating and cooling prior to occupancy.

It is desirable that the outside air duct be large enough to handle 100% of the total circulated air to permit economical operation during mild weather, but in every case it should be large enough to admit 50% more air than called for under ventilation requirements.

Apparatus Rating

Fans employed in connection with air conditioning systems shall be rated in accordance with the provision of the A.S.H.V.E. standard test code for disc and propeller fans, centrifugal fans and blowers; air heaters are to be rated in accordance with the provisions of the A.S.H.V.E. standard code for testing and rating steam unit heaters. Air cleaning devices shall be rated in accordance with the provisions of the A.S.H.V.E. standard code for testing and rating air cleaning devices used in general ventilation work. Comfort cooling apparatus and refrigerating machinery to be rated in accordance with A.S.R.F. standards, which include standard method of rating and testing air conditioning equipment and standard method of rating and testing mechanical condensing units.

Selection of Refrigerating Equipment

City water temperatures as follows can be used:

Milwaukee	70F	Madison	58F
La Crosse	59F	Racine	68F

For other cities, consult the Air Conditioning Bureau of Wisconsin, Post Office Box No. 1860, Milwaukee, Wis.

Well water temperature not less than the value for the months of July and August.

Cooling tower shall deliver water not more than 5F above the design wet-bulb temperature.

Air temperature shall be assumed not less than the design dry-bulb temperature for the rating and selection of the air cooled condensers.

Evaporative condensers shall be selected for a wet-bulb temperature not less than the design wet-bulb.

Refrigerants

Order No. 5875 of the Heating, Ventilating and Air Conditioning Code of the State of Wisconsin is to govern. (Reprinted for convenience as follows:)

REPRINT OF ORDER NO. 5875—REFRIGERANTS

Scope. This order covers the use of refrigerants in heat transfer apparatus for temperature reduction or dehumidification as a function of air conditioning of occupied areas. NOTE: For regulations covering refrigerating machinery, condensers, pressure tests, machinery room enclosures, etc., see the Refrigeration Room Code and the Building Code issued by the Industrial Commission.

Classification of Refrigerants. Refrigerants used in connection with this code shall be classified as follows:

Class I. Non-toxic and non-inflammable refrigerants. Included in this list are: Water or Water Vapor, H_2O; Carbon Dioxide, CO_2; Dichlorodifluoromethane, CCl_2F_2; and Dichlorotetrafluoroethane, $C_2Cl_2F_4$.

Class II. Relatively non-toxic and non-inflammable refrigerants having a sufficiently high boiling point to prevent rapid evaporation in event of release. Included in this list are: Dichlorethylene, $C_2H_2Cl_2$; Methylene Chloride, CH_2Cl_2; Monofluorotrichloromethane, $CFCl_3$; and Trichlorotrifluoroethane, $C_2Cl_3F_3$.

Class III. Irritant and flammable refrigerants. Included in this list are: Ammonia, NH_3; Methyl Chloride, CH_3Cl; and Ethyl Bromide, C_2H_5Br.

Uses, where permitted: Only the refrigerants included in Class I may be used for cooling air by direct expansion or circulation in coils or extended surface cooling apparatus. Refrigerants included in Classes I and II may be used for the purpose of cooling water to be circulated through air washers. Refrigerants included in Classes I, II and III may be used for the purpose of cooling brine or water in a closed system where such brine or water is not circulated directly through the air to be conditioned.

Refrigerants Prohibited. The following toxic and inflammable refrigerants shall not be used for air conditioning purposes: Butane, C_4H_{10}; Iso Butane, C_4H_{10}; Propane, C_3H_8; Ethane. C_2H_6; Ethyl Chloride, C_2H_5Cl; Methyl Bromide. CH_3Cl; Methyl Formate, $C_2H_4O_2$; and Sulphur Dioxide, SO_2.

Noise Control

Noise resulting from the operation of an air conditioning system shall not exceed the loudness level of the noise in the room when the normal activities in the occupied space are in progress and no part of the air conditioning system is operating. The loudness level of both the noise in the room and the noise produced by the air conditioning system shall be expressed in decibels and measured with a sound level meter constructed according to American tentative standards for sound level meters Z24.3—1936. Noise measurements shall be made at a height of 5 ft. from the floor of the space to be air conditioned and no readings shall be taken closer than 5 ft. from any wall, register face, window or ventilating equipment.

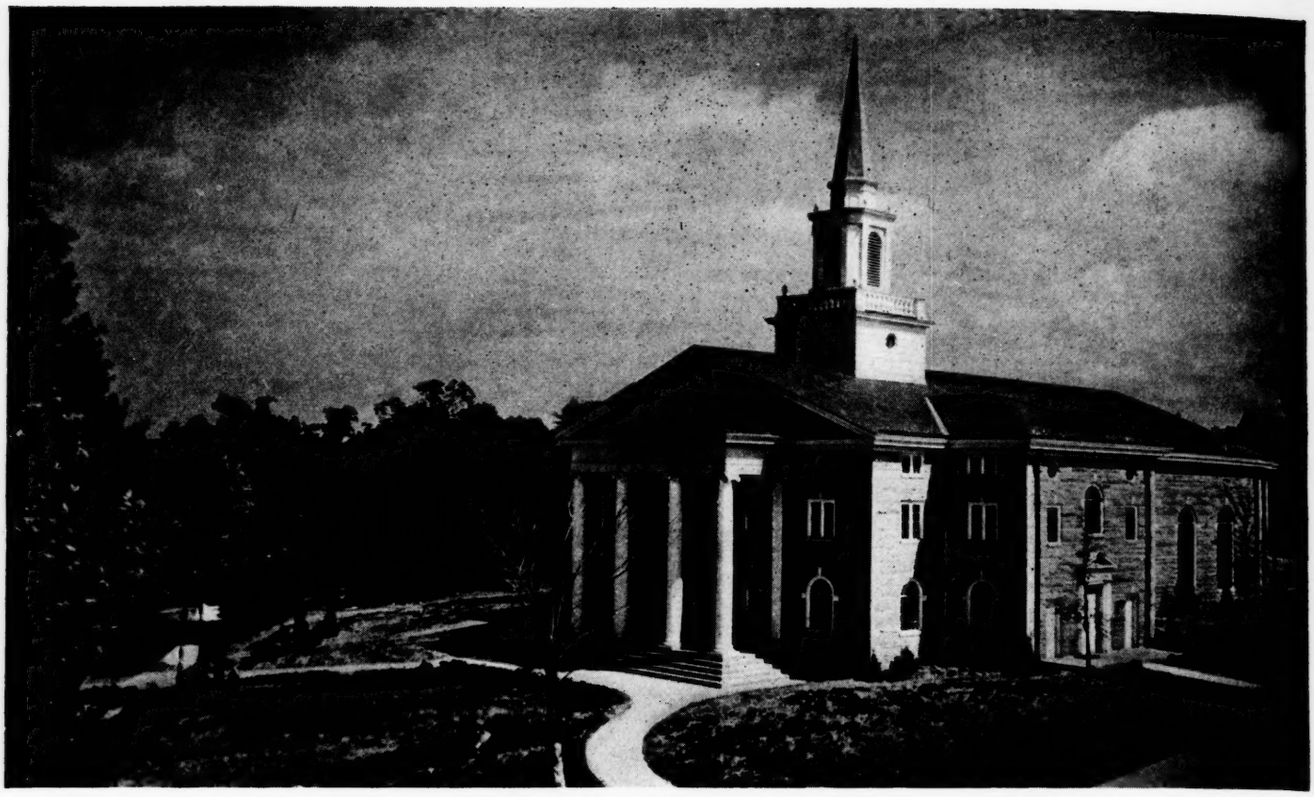
Exception shall be made when the entire ceiling area is used for distribution and the ceiling height is less than 10 ft. in which case readings should be taken at the 5 ft. level regardless of the distance from the ceiling.

To determine the normal noise level in the room. measurements shall be made in not less than 10 different locations uniformly distributed on the plane and within the boundaries specified in these standards. The measurement at each location should be a statistical average of the readings at that location taken once every half minute over a period of five minutes.

Guarantees and Exceptions

Guarantees of performance shall be limited to stated performance and capacities that are described and can be measured, and the guarantees shall state the conditions under which such capacities or results are to obtain.

Exceptions. If a proposed installation differs from the provisions in this code and the particular in which the design departs from the code shall be stated in both the specifications and proposal.



Fourth Church of Christ, Scientist, Indianapolis. The building is heated by an oil-fired warm air furnace.

Year-Round Conditioned Church Cooled by Well Water

THE Fourth Church of Christ, Scientist, in Indianapolis, is one of the few church buildings in the United States which is year-round air conditioned. It is heated in the winter by an oil-fired warm air furnace and cooled in the summer by a well water system. The building structure itself, which is of solid masonry, is of Georgian Colonial architecture and stands upon a slight knoll in a particularly attractive residential suburb on the outskirts of the Hoosier capital city.

Construction

The building contains approximately 180,000 cu. ft., and has a floor area of 8400 sq. ft. The walls are of Indiana limestone backed with cinder block, while the roof is of slate with 1-in. fibrous insulation. All windows are stationary and sealed air-tight, requiring the conditioning of every room in the building in all seasons.

On the first floor is located the church proper, the outlines of the seats being indicated on the drawing by dashed lines. Back of the auditorium is the lobby, and beyond is the main entrance in the front, with supplementary entrances at each side. On either side of the entrance are two reading rooms.

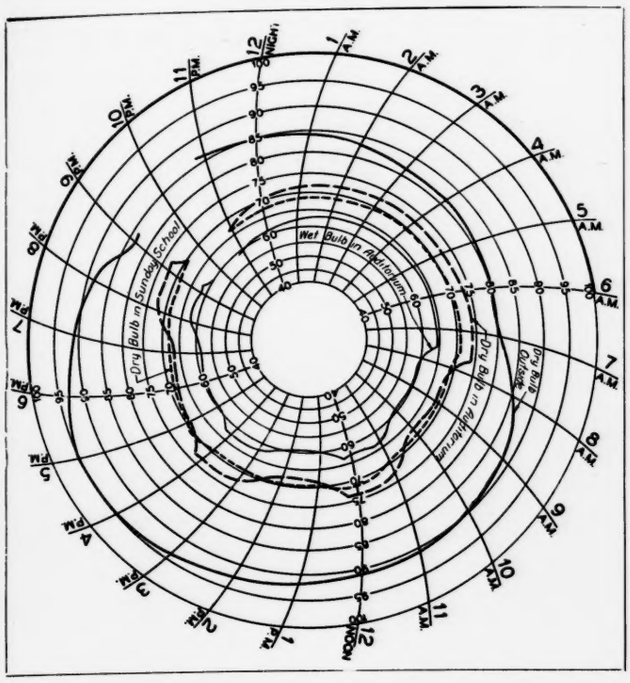
On the second floor is located the Sunday school department, with balconies and mezzanine classrooms.

Because of the intermittent character of its occupancy, high ceilings, and other characteristics peculiar to this type of structure, a church presents difficult problems for the heating and air conditioning engineer. The Indianapolis church described in this article is not only a beautiful example of architecture but is an example of how engineers have solved these difficult heating, humidity and cooling problems.

Air Conditioning Equipment

The equipment room is located in a basement below the first floor. It is divided into a spray or cooling chamber, filter and blower room, heating chamber and utility space. All air supply ducts are connected to the heating chamber. Outside air is drawn through the spray chamber, thence through filters, and delivered by the blowers through the heating chamber to supply ducts. The air flow is controlled by dampers located between spray chamber and filters. Recirculated air passes through the filters to the blower room.

The filters, arranged in a V-bank, serve as water eliminators for both cooling and hu-



Tracing of temperature recording chart for the church from 11 p.m. Saturday, August 22, 1936, to 9:30 p.m., Sunday, August 23, 1936. The cooling system was operated all day on Saturday, shut down at night, started 7:30 Sunday morning, and operated continuously until 9:15 p.m., Sunday. Three services were held Sunday, morning, afternoon and evening, with approximately 1100 people present at all services. Reading rooms and Sunday school rooms, church, and other rooms filled with people in temporary seats.

midifying sprays as well as for air cleaning. Five atomizing type humidifying sprays are arranged as flooding sprays behind the filters and are supplied with city water through a solenoid valve.

To permit economical conditioning of the reading rooms, lobby and front entrances during week-days when the auditorium and Sunday school department are not in use, two blowers are used, one driven by a 2-hp. electric motor and the other by a 3-hp. motor. The small blower alone is used for week-day operation, with both blowers operated when all of the building is in use.

In the heater chamber is a large oil-fired warm air furnace, concealed and separated from the utility space with an attractive metal casing, which is insulated with 2-in. fireproof wool insulation. The furnace, especially designed for church heating, has a ratio of heating surface to grate area of 34 to 1, and a capacity of 1,400,000 B.t.u. per hr. This supplies a building heat loss of 628,960 B.t.u. per hr., computed with an 80F temperature rise plus the Sunday morning heating-up load. It has been determined that additional capacity in the heater about equal to the heat loss load is required to heat up the cold materials in such a church building within a reasonable length of time after they have been allowed to cool down during the week.

The heater chamber is made large to accommodate an unusually large volume of air for summer cooling. About halfway between its top and bottom is a sheet metal deck or baffle, which separates blower discharges from the supply duct connections. It is arranged with openings around the furnace in such manner that air from the blowers is directed first over the secondary heating surface of the furnace, then over the primary heating surface before reaching the supply ducts. In addition to heat openings through this deck, there is a large bypass damper located directly in front of the outlet of the large blower. When it is opened for summer cooling, most of the air bypasses the furnace directly to the supply ducts.

Summer cooling of the air is accomplished with a two-stage air washer spray system supplied with 300 g.p.m. of 52F well water from a 15-hp. well pump. Spray water is wasted to the sewer. A float switch in the filter room is set to stop the well pump in case of sewer sump stoppage, preventing flooding of the basement. For a seating capacity of 800 during services, the cooling system was designed to maintain 80F dry bulb with not over 50% relative humidity inside, when it is 95F and 77F dry and wet bulb outside, with a rise of 5F in temperature of water entering and leaving spray chamber. Because of uncertainty as to exact temperature of well water obtainable, about 25% surplus pump and spray capacity is provided.

For summer cooling no air is recirculated and outside air is drawn into the spray chamber through a steel grating at ground level, and vented from the building through large ceiling vents. For heating, the air is largely recirculated, with outside air automatically added for temperature control.

Distribution

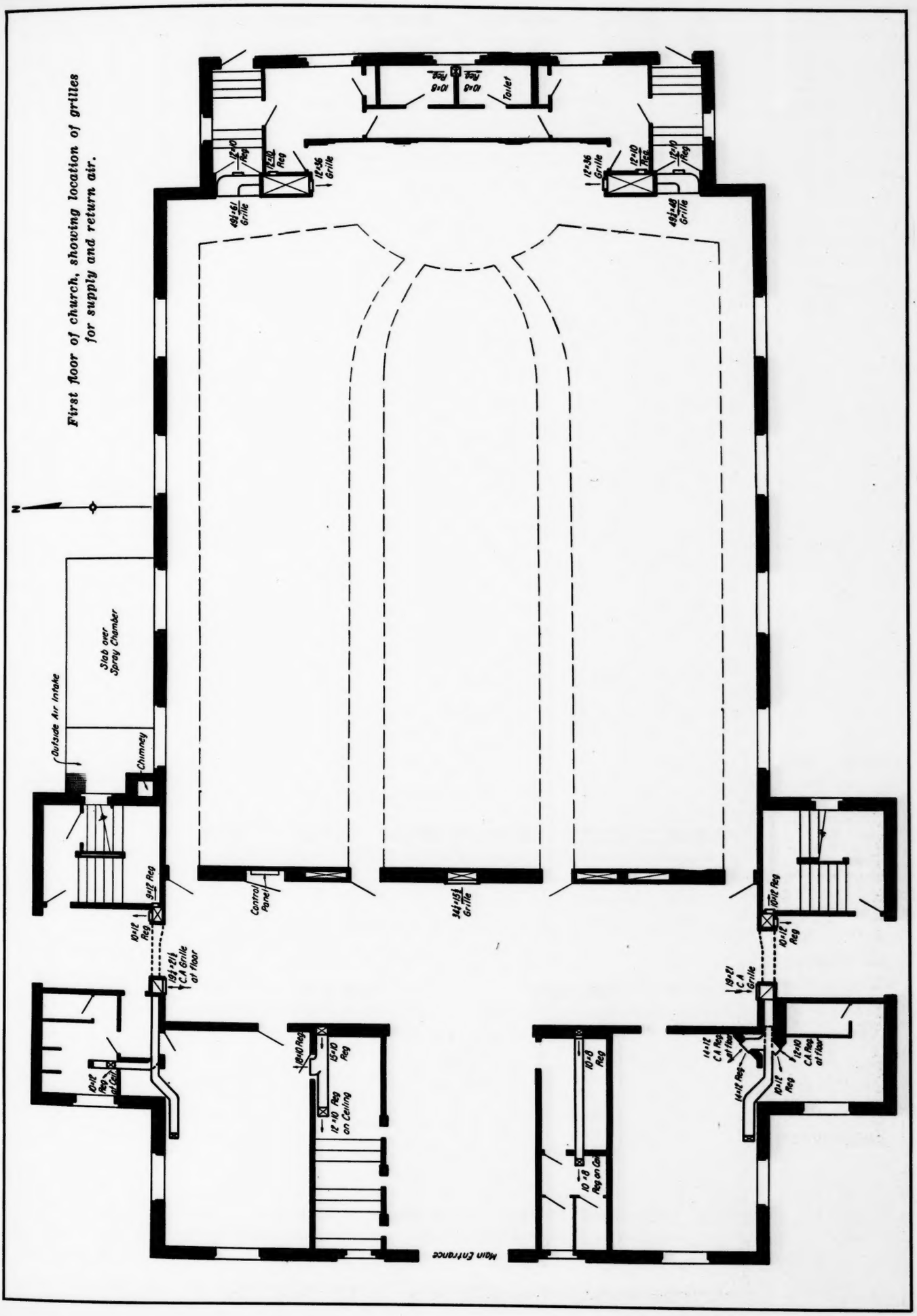
Conditioned air is supplied to each room in the building from the heating chamber through ducts as shown in the accompanying illustrations The greater volume is carried through masonry ducts under the first floor to galvanized metal risers, and a portion directly from the basement through galvanized ducts. Return air is conveyed from the rooms to the filter and blower room through masonry ducts located in most cases directly underneath the underground supply ducts. Each main supply and each return duct is equipped with a manually-operated pivot damper for volume control and for closing off air to and from rooms not in use at times.

Air enters the rooms through conventional grilles from six to eight feet above the floor level, with return grilles at the floor. Distribution within the large rooms is obtained by volume of air moved rather than by a multiplicity of ducts and outlets. The blowers are equipped with two speeds, delivering 15,000 c.f.m. of air to the building for a 10-min. air change in winter, and 30,000 c.f.m. for a 5-min. air change in summer.

The photograph of the auditorium shows the location of supply grille over exit doors on each side of the platform and the return grilles in face of the platform. There are no additional grilles for air conditioning in the auditorium. Concealed behind the supply grilles are adjustable curved louvers, which are set to spread and raise the air stream to avoid drafts or objectionable movement of air at the seating level.

Air is vented from the building through large grilles on ceilings of the auditorium and Sunday school department. The vent grilles are connected with ducts

Basement of the church, showing arrangement of heater, spray room, ducts and other air conditioning equipment.


First floor of church, showing location of grilles for supply and return air.
N
Slab over Spray Chamber
Outside Air Intake
Chimney
Toilet
Control Panel
Main Entrance

to vent louvers in the base of the tower, and are equipped with dampers.

Services are held simultaneously in the church auditorium and in the Sunday school; consequently, all ducts and vents are so arranged that sound cannot be conveyed through them from one room to another.

Controls

The control of the air conditioning system is semi-automatic and is made as simple and direct as possible, suitable for handling by inexperienced operators. A central control panel is located in the front lobby and concealed in a wall niche, covered with a door. Centered on the control panel, directly behind a small window in the door, is a recording hygrometer, which shows the dry bulb temperatures of the auditorium and Sunday school department and the wet bulb temperature of the auditorium. Below it are switches controlling the oil burner, the humidifier and cooling sprays, the blower motors and a portion of the dampers. An usher on duty in the lobby during services observes the temperatures as indicated on the hygrometer at frequent intervals and manipulates controls accordingly.

Normally the oil burner is controlled by a room thermostat in the auditorium for Sunday services and by a thermostat in a reading room for week-day occupancy, but a switch at the control panel permits manual operation for certain conditions of occupancy.

Outside air intake and ceiling vent dampers are controlled by thermostats in the auditorium and the Sunday school rooms, connected to electric damper motors, and set to open dampers when rooms become overheated. These dampers may also be operated manually with switches at the control board in order to provide for special conditions which may arise.

The blowers are kept in operation continuously during services, but after Sunday services when the switch for the small blower is turned to the "off" position at the control board, the blower is put under control of a thermostatic switch in the heater chamber. It is then operated automatically by furnace temperature to maintain night temperatures in the building, and comfortable conditions in the small rooms occupied during the week.

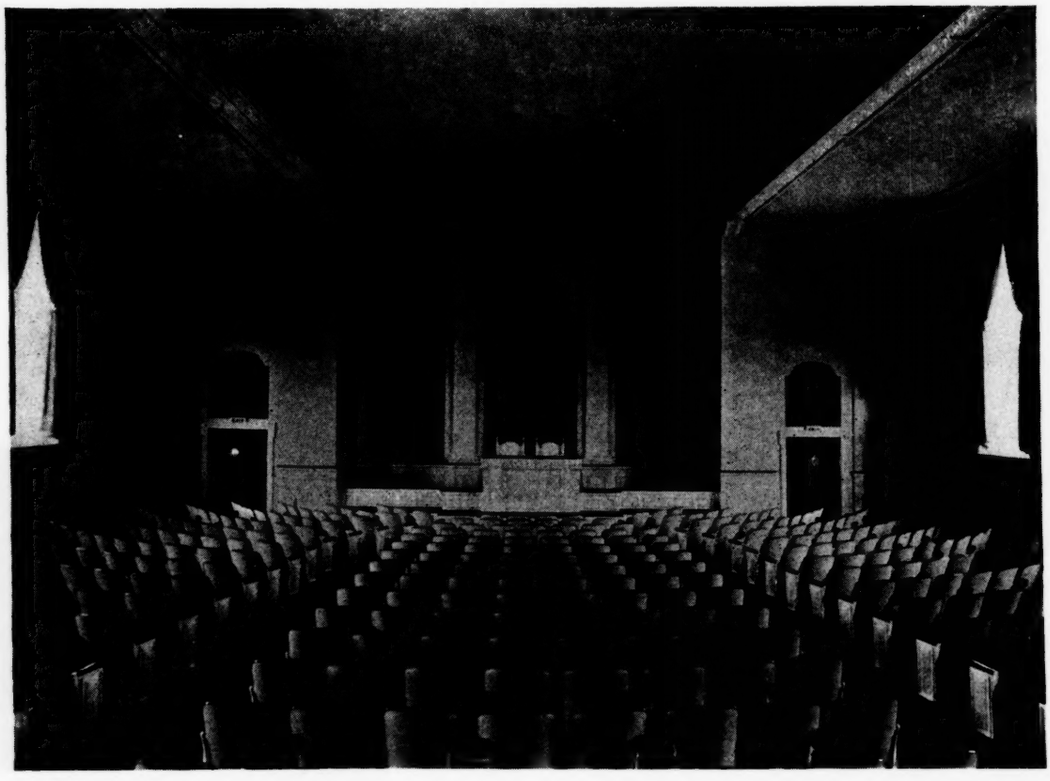
Results

At the dedication of the church in August, 1936, the cooling system was operated at full capacity throughout three packed services during the day. With an outside dry bulb temperature varying between 89 and 96F, the recording hygrometer chart, a tracing of which is illustrated, showed that the inside dry bulb fluctuated between 69 and 73F, with an inside wet bulb of 59 to 63F.

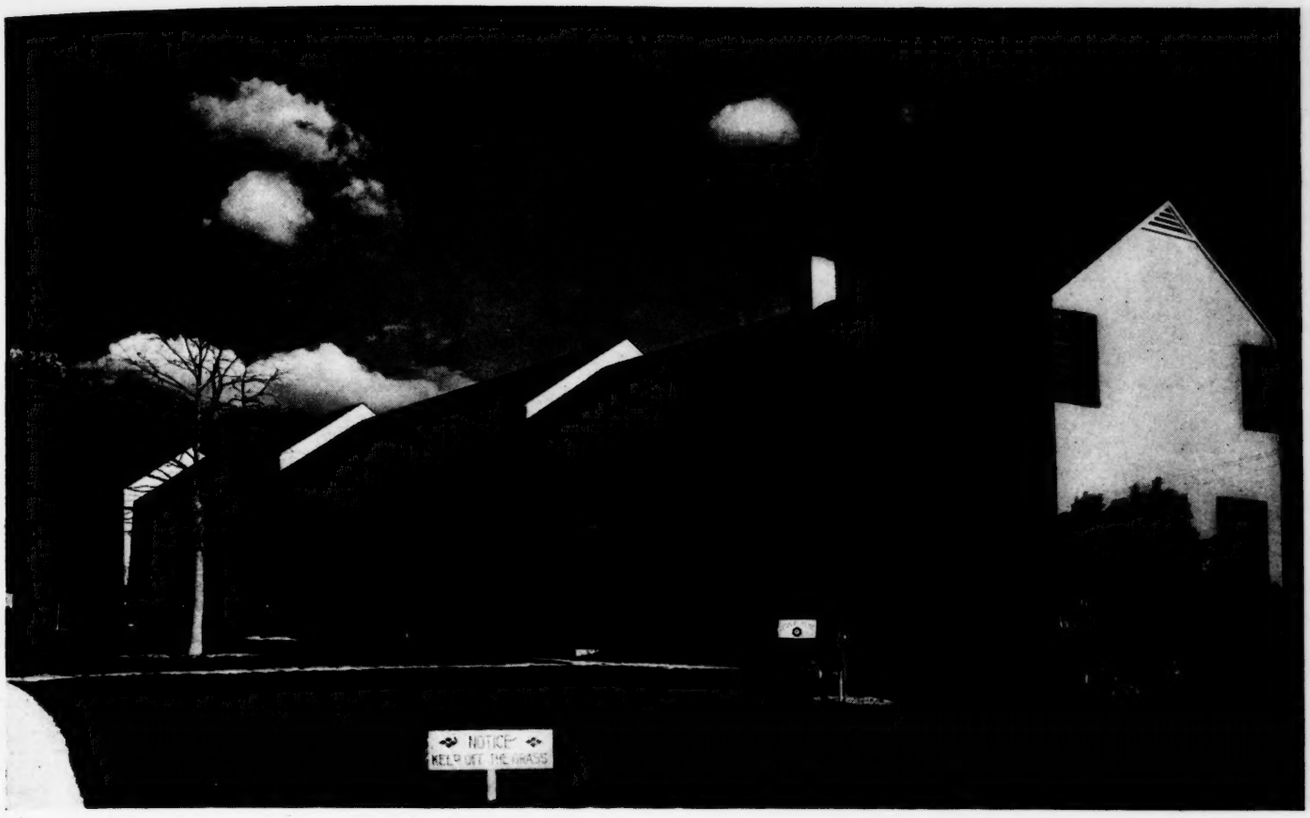
The total operating cost of the cooling system at full capacity, equivalent to 60 tons of refrigeration, is 64 cents per hour. The fuel cost for the heating season of 1936-7, during which 6358 gal. of No 3 fuel oil at 7.7c per gal. were burned, was $509.58.

Few visitors have entered the building, either summer or winter, without remarking about the sense of freshness in the air due not only to comfortable conditioning, but to an unusually large air movement in the rooms.

The building was designed and erected by the Foster Engineering Co., architects and engineers, of Indianapolis. The air conditioning system was designed and installed by the E. K. Campbell Heating Company of Kansas City and St. Louis.



Interior of the church proper, looking toward the rostrum.



Group of low-cost residences erected by the Resettlement Administration at Greenbelt, Md. Photo by Galloway.

Design of Automatic Heating Systems for Low-Cost Residences†

By ROBERT K. THULMAN‡

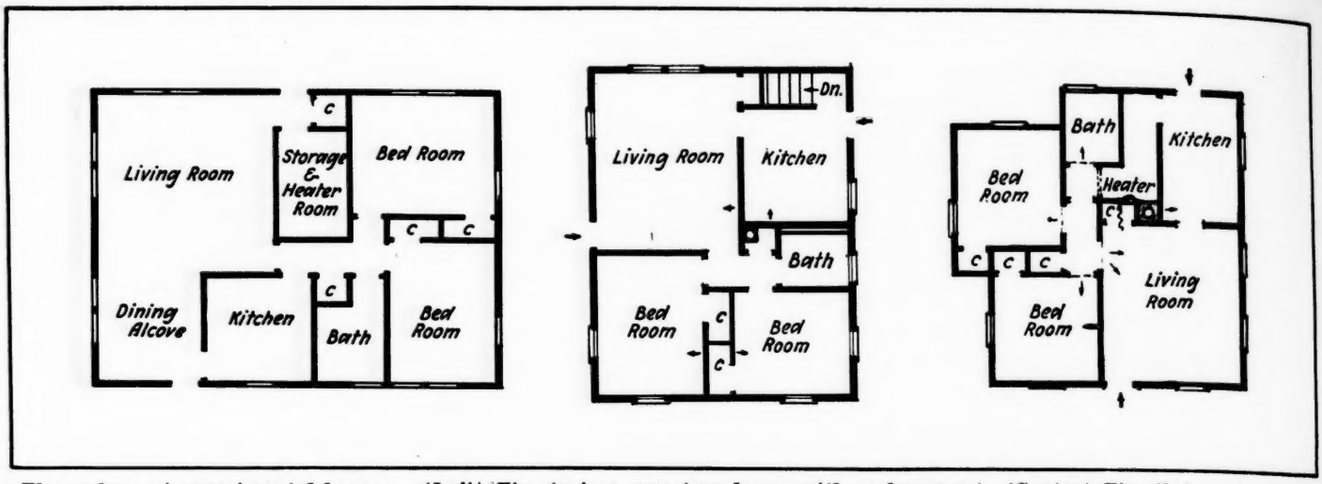
CONSTRUCTION of a group of individual houses at the Resettlement Administration Suburban Project at Greenbelt, Maryland, with the primary objective of developing a system of plywood factory-fabricated superstructures on an experimental basis, afforded an excellent opportunity to carry on, as a secondary objective, a certain amount of experimentation in the design of heating systems for these houses, with definite economic and performance standards as the governing factors in the design. It was intended that these experimental houses, like the rest of the houses in Greenbelt, were to be rented to families with an income of less than $2000 per year.

In the development of basic specifications for low cost heating for low cost housing the most important governing factor is necessarily economic. It is essential to keep the operating cost of heating at a minimum even if this means that space, light, and ventilation must also be kept at a safe and appropriate minimum and cannot be increased to something better. It seems to be a safe prediction that the popularity of any particular solution of the low cost housing problem will be measured by the degree to which that solution includes comfort facilities even greater than those at present tolerated in much of the housing designed for higher income groups. Any solution of the low cost housing problem will be judged ultimately successful if the particular income group for which the housing is designed continues to live in it. This group will continue to occupy such housing only if it can afford to.

Regardless of what form a housing project may take, the fundamental heating problem is the same; namely, to provide, at a first cost consistent with the cost of the house, heating equipment which, with reasonable care and attention, will maintain proper and acceptable comfort at an operation and maintenance cost which can be readily afforded by the income group for which the project is intended. The relation between income and heating operating cost should be just as definite as the relation between income and total rent or cost of ownership, except insofar as compensation must be made for variation in weather conditions. In the absence of a definitely determined budget cost of heating

†This article is not officially approved by the Resettlement Administration.

‡Heating Engineer, Resettlement Administration, Washington, D. C.



Floor plans of experimental houses. (Left) Fig. 1a is a one-story house with no basement. (Center) Fig. 1b is a one-story house without basement. Originally designed to be a two-story structure. (Right) Fig. 1c, one-story house with basement, was erected on a foundation planned originally for two floors.

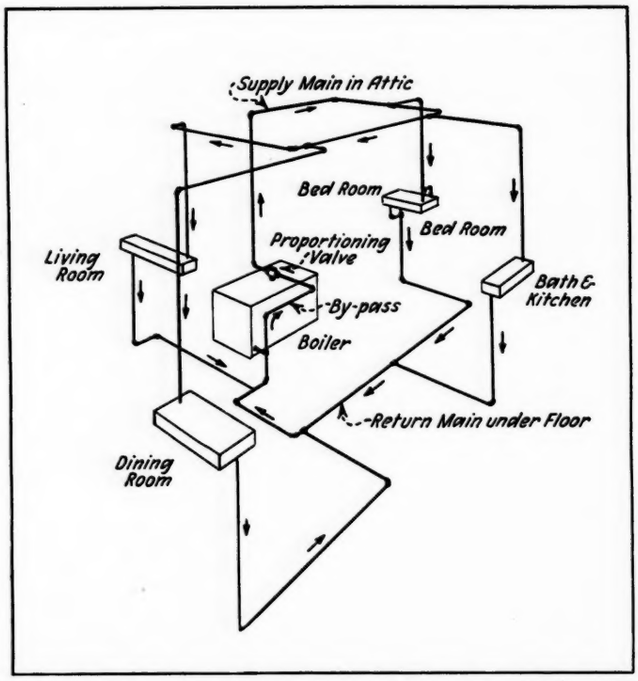


Fig. 2. Schematic diagram showing hot water heating system as installed in first house. Note convectors are on higher level than boiler.

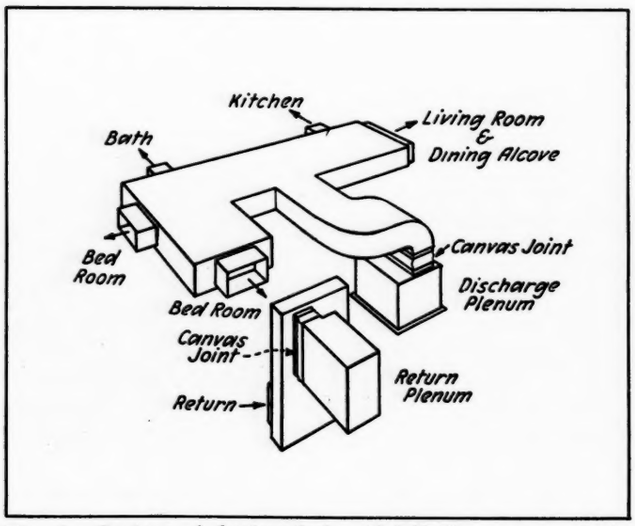


Fig. 3. System of ductwork for distributing warm air in second house.

set forth in cost of living budgets and as a result of a considerable amount of study on this subject made during the time the writer was associated with the Rural Resettlement Administration, a figure of 3.3 per cent of the income as the annual cost of keeping warm a family located in the vicinity of Washington, D. C., was set up.

Performance standards for these experimental houses stipulated that an inside temperature of 70 degrees should be provided when the outside temperature was zero, and that this temperature should be uniform from room to room. The realization of the economic objective was considerably simplified due to the cooperation of the architectural and structural designers of these houses in providing a very effective insulation in the exterior walls and roof and in maintaining reasonable window areas. It was found that the maximum hourly heat loss could be kept down to 45,000 B.T.U. per hour without undue sacrifice of architectural amenities and without necessitating any departure from already established standards included in the housing for the town itself. With a maximum hourly heat loss of 45,000 B.T.U. it was necessary to provide equipment with an overall efficiency of at least 70 percent in order to come within the yearly budget operating cost of $66. Gas was not available at the project, and all the other buildings in the town were oil-fired, so that the use of oil fuel was more or less definitely indicated. The price of oil was, for the purpose of calculation, set at $.065 per gallon.

The first three houses are identical in plan: one-story houses with no basement as shown in Fig. 1a. The system designed for the first house consists of a small direct-fired domestic hot water heater with the burner an integral part of the unit; a supply main located in the attic space feeding four convectors spaced 38 in. off the floor; and a return main in the space below the floor. The system used is the conventional reversed return, and circulation of the hot water is by means of gravity, making it necessary to place the convector units on a higher level than the boiler. This is shown in Fig. 2. Two of the convectors are used to heat two rooms each. See Figs. 4 and 7. Supply grilles are located

fairly close to the ceiling with returns just above the floor level. Convectors are all located on interior walls so as to require a minimum of piping and a maximum heating effect due to the use of high stack heads. Supply and return mains are made up of copper sweat fittings and copper pipe, and the boiler itself is galvanized. Consequently the water used as the heating medium is available for domestic use directly from the system. It was believed that the rapid heating and quick cooling common to convector heating would result in an aggravated "cold 70" condition, and to overcome this a means of varying the heating medium temperature is provided.

The device used to accomplish this is thermostatically controlled from outside the building and operated so that the proportion of hot boiler water to cooler return water is varied in accordance with the outside temperature. This device also accomplishes the further objective of providing a maximum indoor temperature which the tenant of the house cannot change, thus preventing any possibility of wasted heat which might occur if the tenant were allowed to control the temperature of the building by means of an inside thermostat. It also prevented the possibility of wasted heat due to injudicious or deliberate over-ventilation. This system of control is utilized in all the other designs of the experimental group and also in the heating systems of the other residential buildings in the town, all of which were row or apartment buildings.

With introduction of hot air from the convectors at a point close to the ceiling, a high floor-to-ceiling temperature differential will natually occur, but here again it was felt that the continuousness of the heat output would materially reduce such discomfort as might be caused by this condition.

The system designed for the second house consists of the same boiler-burner unit used in the first job, from which hot water is circulated by means of a pump through a heat exchanger, the temperature of the water being controlled from outdoors in the same manner as that used in the first house. See Fig. 5. A double inlet, double width, centrifugal blower is located on the discharge side of the heat exchanger and discharges air into a small plenum from which it is led, by means of a duct, into a plenum chamber located in a furred space of the hallway. Outlets from this plenum are provided in the panels over the doors leading to the

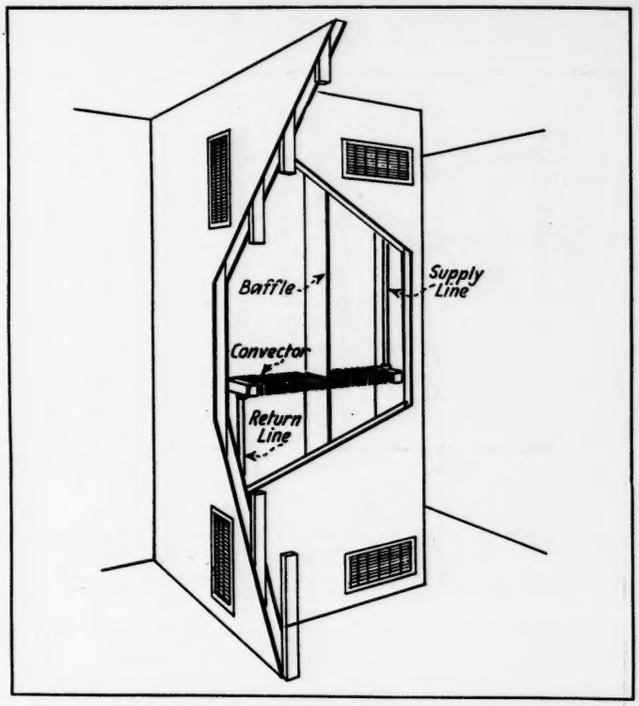


Fig. 4. Convector used to heat two rooms in first house.

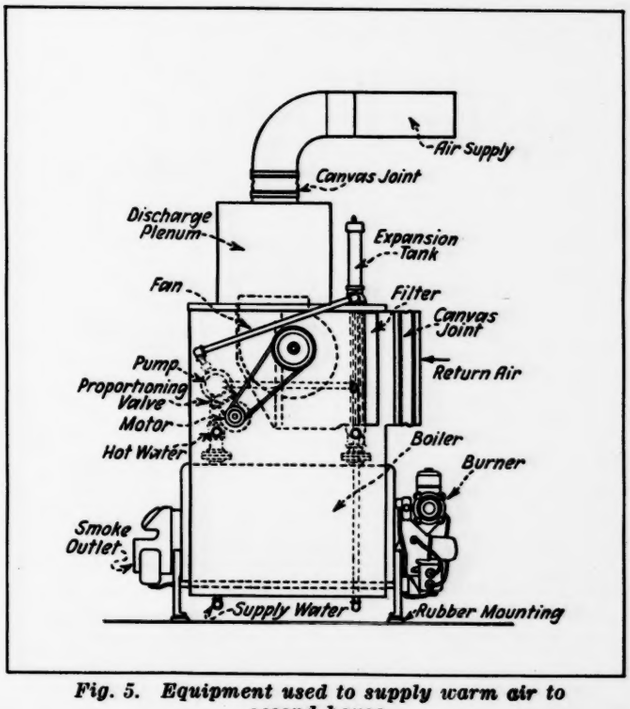
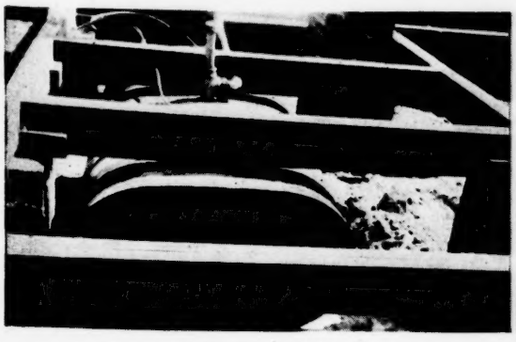
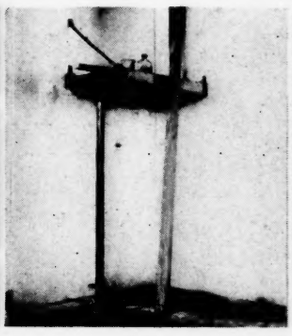


Fig. 5. Equipment used to supply warm air to second house.





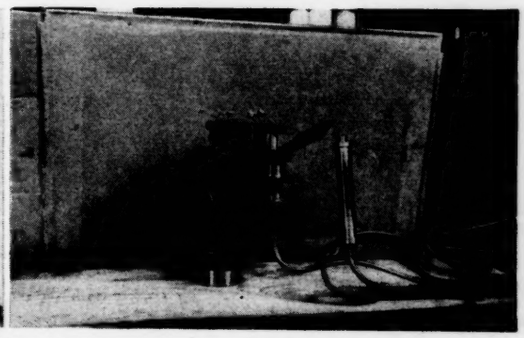


Fig. 6. (Left) Oil storage tanks are placed beneath the floors of the houses not having basements. Photo taken before flooring was applied. Fig. 7. (Center) One of the hot water convectors used for heating two rooms. Fig. 8. (Right) Outside temperature control and hot water mixing valve which regulate temperatures of the hot water to the heating surfaces.

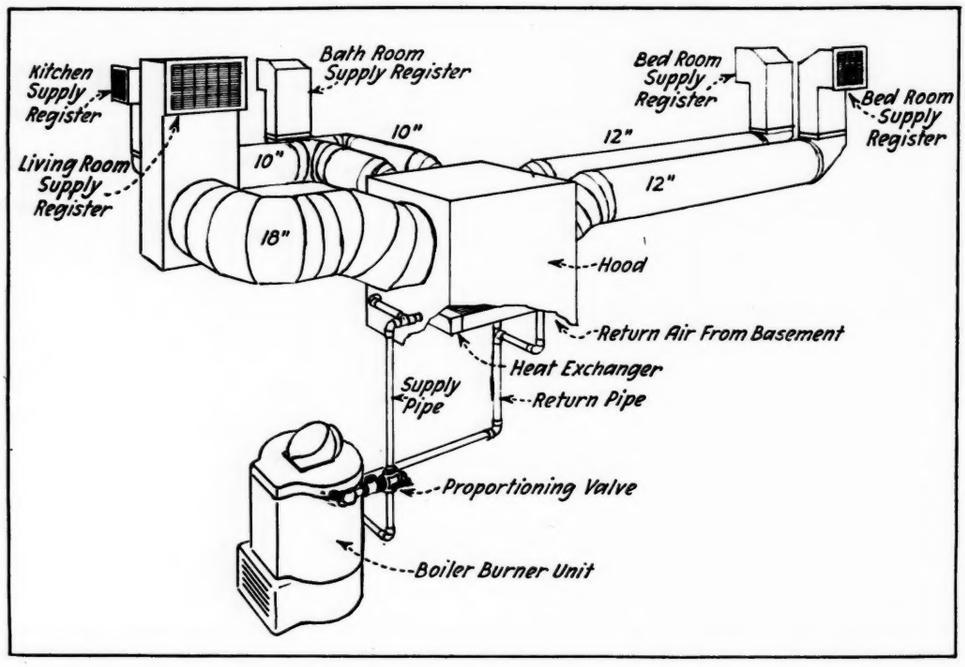


Fig. 9. Heating system installed in the fifth house. This scheme is very similar to a small warm air furnace job with the exception that an indirect heater is used in place of the direct fired furnace.

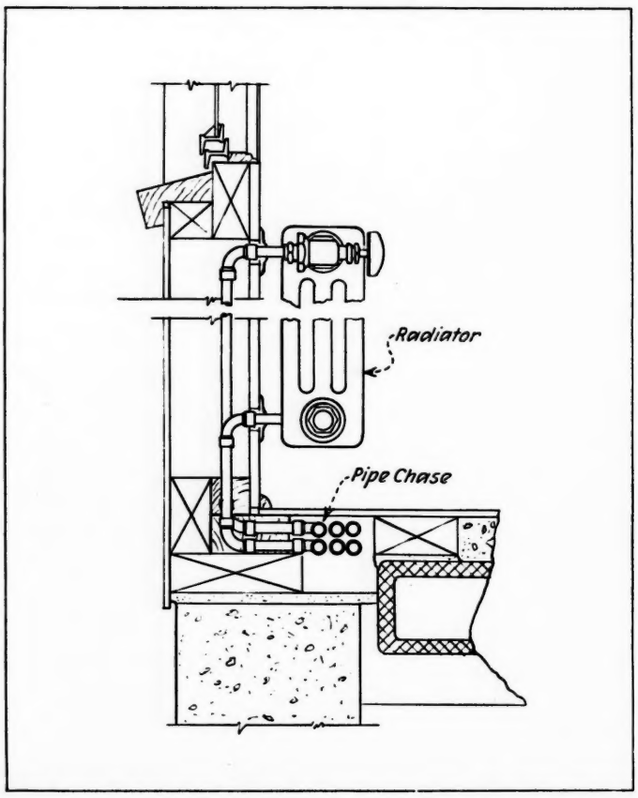


Fig. 10. Piping details of hot water radiator as installed in the third house. A small chase in the concrete floor slab carries hot water supply and return pipes.

living room, kitchen, bathroom, and two bedrooms. Registers are provided in these outlets with means for directional flow and volume control. A return grill is located in the hall space itself, and opens into a plenum chamber connected to the inlet side of the heat exchanger with provision for filtering. This is illustrated in Fig. 3. Here again it was felt that the type of control used would prevent the common "cold 70" condition ordinarily occurring in forced warm air heating systems, by varying the water temperature in the blast core, which in turn naturally varies the outlet air temperature and results in greatly extended fan operation. The design of the pump is such that the impeller can be readily removed and the effect of gravity circulation on the performance of the unit observed. In this system also the domestic hot water is taken directly from the boiler as the blast core and the piping to it are non-corrosive.

Construction of the third house definitely limited the type of heating system that could be used. This house has a flat roof and a concrete slab floor, with consequently no space provided for piping distribution. We could have used the air heating system in the third house, but it was felt desirable to try a forced circulation system of hot water. A small chase is provided in the concrete slab all around the perimeter of the house just inside the exterior wall line. See Fig. 10.

An added objective to the design of this heating system was the provision of a large amount of flexibility which would be necessary if similar houses were erected in other localities with other exposures requiring different amounts of radiation. Consequently a separate and complete circuit of small diameter copper tubing is provided for each radiator. Six radiators were necessary and the six circuits are connected in the boiler room to headers, consisting of cast iron branch tees. A sketch of a header appears in Fig. 11. In the supply to each radiator at the header a balancing fitting was provided. The outlet of the return header was connected to the suction side of a 1½ in. circulator discharging back to the boiler and also discharging into a by-pass line connected to the proportioning valve.

Since there is no necessity in this type of system for an extremely low boiler, an ordinary low cost cast iron sectional boiler is used and fired with a gravity type oil burner. Domestic hot water is provided by means of a tankless indirect heater attached directly to the boiler, the return circulating line from this heater being brought back to the boiler through a tee provided

with an extended pipe to form an injector on the discharge line from the pump. See Fig 13. It was felt that this injector would accelerate the circulation through the domestic water heater when the pump is in operation. The type of control, which is the same as that used in the other houses, was felt to accomplish an additional objective by extending the time of pump operation and also effectually eliminating the sudden discharge of hot water from the boiler with the ordinarily disastrous effect on the output of indirect heaters.

The fourth house, Fig. 1b, was originally intended to be a two-story structure without a basement and a heater space 3 ft. 1 in. x 6 ft. 5 in. was provided with access at one end. The same unit designed for the second house was modified somewhat to fit this space condition and instead of using the plenum chamber which we had designed for the second house, a system of trunk ducts was used. Insofar as was practicable the supply system was designed to use prefabricated warm air fittings. However, changes in the program caused the abandonment of the two-story idea and the substitution on the same foundation of a one-story house considerably smaller in size. Since we were able to obtain the boiler-burner unit and the air heater from a single manufacturer at a considerable saving in first cost and, since the plan of the house lent itself very readily to an economical system of distribution, the same heater unit intended for the two-story house was used for this job. Due to the use of double hung wood windows and also due to the smaller size of the house, this unit was considerably larger than necessary, but it was felt that the use of it would be well worth while in this case to indicate the degree of flexibility obtainable in a unit of this kind. For example, where 200 degree water temperature might be necessary for the second house, only 160 degrees would probably be the maximum requirement for the smaller house. If units of this type provide a desirable form of heating, it would naturally be desirable for a manufacturer to construct as few sizes as possible in the interest of production economy.

The fifth house, Fig. 1c, was also originally intended to be a two-story house and was provided with a basement. This, too, was changed to a one-story house which was planned to fit essentially the same foundation. The only real fault in the performance of the system for the first house where the gravity convectors were used

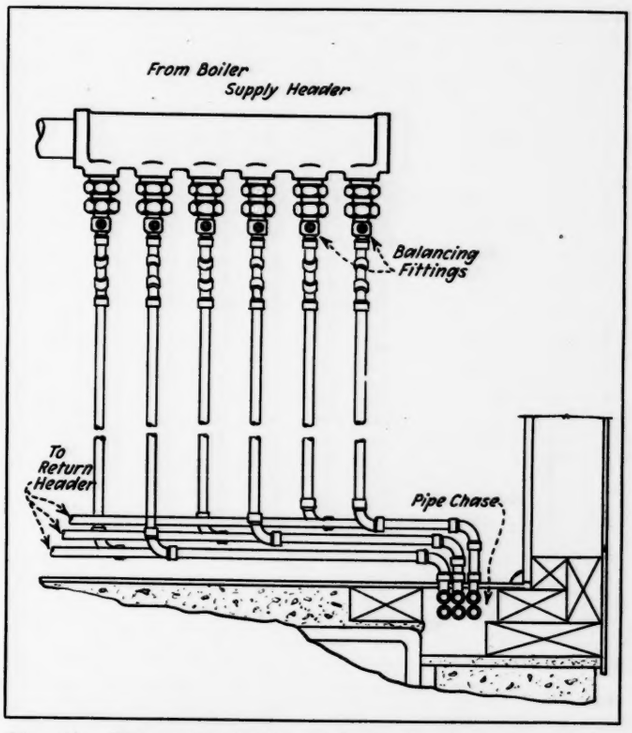


Fig. 11. Hot water header and supply pipes to radiators as used in the heating system of the third house. Small copper tubes carry the hot water to each radiator.

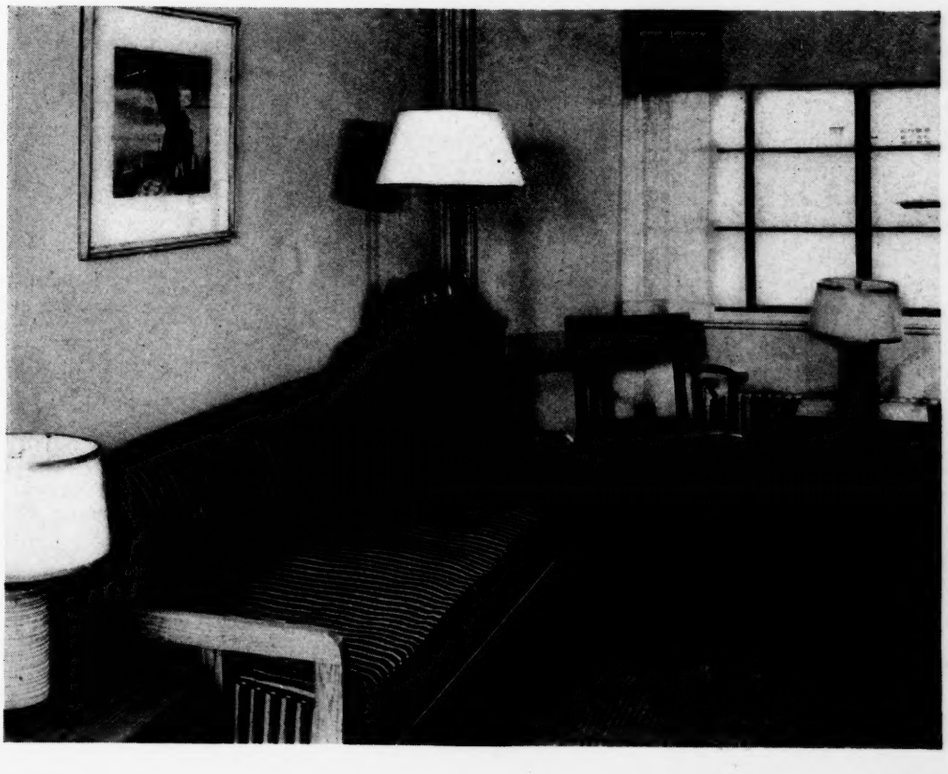


Fig. 12. Typical living room in one of the Greenbelt Village low-cost houses which were erected near Berwyn, Md., by the Resettlement Administration. Photo by Acme.

was the high floor-to-ceiling temperature difference, and the possibilities of the system were such that it seemed desirable to try a similar scheme in the fifth house. Since we had a basement, the necessity of locating the convectors well off the floor did not exist and since the basement provided space for an effective means of distribution, the system was laid out so that all the convector requirements were concentrated in one single unit.

It was decided to try another type of boiler-burner unit, consisting of a vertical rotary oil burner and pipe coil heater. Since this unit was very deficient in water content and its capacity was only sufficient to provide for the instantaneous heating of approximately one gallon of water per minute, it was necessary to provide a storage tank for the domestic hot water supply. A sheet metal hood was designed to fit over the top of the convector and to it five branch ducts are attached, leading to two register boxes in the closet space between the bedrooms, two similar boxes in back of the linen closet leading to the bathroom and kitchen, and a third register box in the living room. See Fig. 9. The entire intake side of the convector is left exposed and return air taken from grills in the floors of the living room and the two bedrooms, the entire cellar being used as a return air chamber. The entire scheme is very similar to a small warm air furnace job with the exception that an indirect heater is used instead of a direct-fired furnace.

In all the systems designed for this group of houses, we have what amounts to various kinds of heating systems attached to a domestic hot water heater, contrasted with the customary scheme of attaching the domestic hot water heater to the heating system. No attempt was made to provide equipment capable of taking care of a simultaneous maximum heating and maximum hot water load. If, in the case of the first, second, and fourth systems, a large quantity of water is drawn for domestic use so that all the hot water in the boiler is discharged, there will be a period when no heat for the house will be available, but it was believed that it will only take about 20 minutes to reheat the boiler to the proper temperature and during that 20 minutes there would be sufficient latent heat in the house so that the temporary lack of heat output of the unit or convectors will not be felt. It may be necessary to install a reverse acting thermostatic switch to cut off the fan when there is no heat in the heat exchanger to avoid a cold blast of air in the case of the second and fourth houses. Only actual operation of the system will prove this.

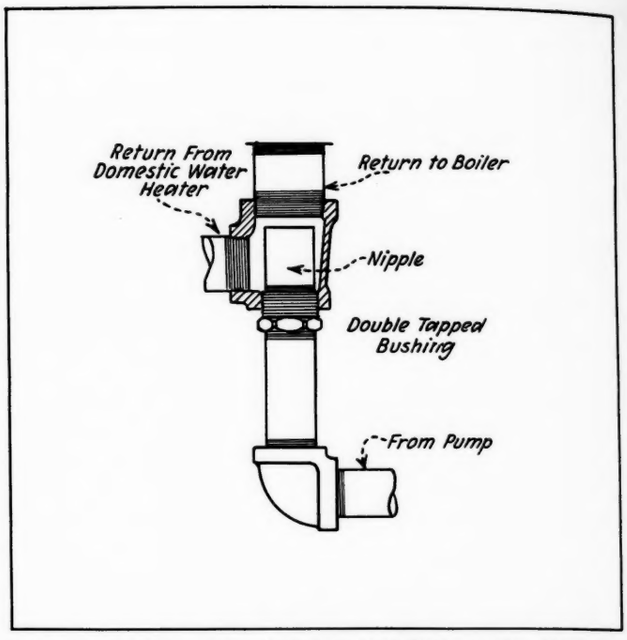


Fig. 13. Sketch of the injector installed on the discharge line of the hot water circulating pump in the heating system of the third house. Purpose of the injector is to accelerate the circulation through the domestic water heater.

In the third house where the water is heated indirectly, the combination of latent heat in the boiler water and fairly rapid recovery of lowered boiler water temperature will probably overcome any discomfort in heating which might occur due to a heavy draw on the domestic water system.

In the fifth house, the use of the storage tank will effect the same result.

Comparisons both of first cost and operating cost of the various systems used and the degree to which they approach or surpass performance requirements set up for them will not, of course, be available until after they have been in operation for at least one heating season. During the development of the design of these systems a great many manufacturers of heating equipment were interviewed. Many of them offered helpful suggestions and some of them were equipped to furnish material adaptable to the purposes, but development by any manufacturer, large or small, of a complete, coordinated, logical, economical heating system for houses this small was conspicuous by its absence. That there is a demand for efficient low cost heating equipment for a small house there can be no doubt. It is hoped that the attempt made in this particular project will at least indicate to some extent the possibilities for development of a good heating system for the small house.

Fig. 14. Exterior of the first house during construction. This house is heated by a gravity circulation hot water system utilizing convectors.

Air Conditioning in Industry

Part 7—What Are the Best Conditions for the Workers?

By MARY O. SOROKA†

THUS far in this series we have not stated what the most advantageous air conditions for workers in each industry are. In some industries temperatures or relative humidities are fixed by the necessities of the manufacturing process. In that event, comfort conditions are limited to conform with the requirements. Comfortable temperatures depend upon the type of work performed since the greater the muscular activity the greater the heat produced and the lower the effective temperature desired. Values also depend upon the age of the worker, the sex, the type of clothing worn, the state of health, and the geographic region. The degree of acquired adaptation is important and comfort standards differ in winter and summer.

Some general statements are included for guidance. Vernon concluded from a study of different occupations that a temperature of 60F to 65F is most suitable for ordinary machine work, presumably with a relative humidity of approximately 50 to 60%. The upper limit in atmospheric conditions at which work can be performed with any semblance of efficiency corresponds to a dry bulb temperature of 100F and a relative humidity of 30%. For ordinary humidities of 60%, five times more work is performed in a temperature of 90F than one of 120F. The minimum accident frequency in factory work for both men and women was observed at about 68F.

The New York State Commission on Ventilation investigated the problem of disinclination to perform muscular work in a hot humid atmosphere to determine whether there was an actual diminution of working power. From its study it was found that even when men were urged to work they accomplished 28% less total work in a day in an atmosphere of 86F and 80% relative humidity than at 68F and 50% relative humidity. When left by themselves but stimulated by a bonus they performed per man per hour. under the following four atmospheric conditions, the percentages of work indicated:

Type of Air	Dry Bulb Temp., F.	Relative Accomplishment
Fresh	68	100
Stagnant	68	91.1
Fresh	75	85.2
Stagnant	75	76.6

The normal human organism can adapt itself to a wide range of air conditions but acclimatization to extremes produces a severe strain upon the heat regulating mechanism and interferes with the normal functions of the body. The ability of the body to maintain its heat equilibrium is limited and it is more successful for extreme low temperature than extreme high temperature. However, energy which should be devoted to muscular or mental work is wasted when it is diverted to cooling the body.

†Engineer, Julien P. Friez & Sons, Inc., subsidiary Bendix Aviation Corp., Baltimore, Md.

Under normal conditions the greater part of the heat from the surface of the body is dissipated as sensible heat by radiation to surrounding objects and conduction to the surrounding air. The body defends itself further against overheating by evaporation of water from the lungs and skin. The controlling factor in the maximum possible rate of cooling through perspiration is the wet bulb temperature of the surrounding air. That is why an increase in the moisture content of the air is more serious than an increase in the temperature.

High environmental temperatures and high humidities produce a rise in body temperature owing to interference with the normal loss of body heat. The pulse rate increases and there is a shift of blood to the peripheral vessels of the skin leaving the intestinal wall in an anaemic condition. Perspiration, though, contains chlorides, and under very high temperatures the loss of chlorides through sweating causes cramps. Continued exposure to high temperature diminishes the amount of gastric secretions as well as their acidity and digestive activity. The stomach loses some of its power to act on food and there is a corresponding loss in the antiseptic and anti-fermentative action of the gastric juice which favors the growth of bacteria in the intestinal tract. As sweating takes place the volume of circulatory blood supply may be materially reduced through the loss of water from the blood. The result is insufficient blood returning through the veins for which the heart compensates by beating faster. It is believed that the lassitude experienced is due to the relatively anaemic condition of the brain.

The hot weather effects on the human system are manifest chiefly in diseases of the intestinal tract. Cold weather disturbances are chiefly associated with respiratory disease. Since many of the physical disturbances in winter are the result of faulty methods used in heating buildings, these effects can be eliminated by air conditioning. The mucous membrane of the nose and throat secretes a fluid which under normal conditions adds moisture to the air before it reaches the lungs. Under the abnormal conditions of ordinary heating systems, by which the air becomes over-dry, the mucous membrane is overtaxed and the nasal secretion is dried up. The result is a serious irritation to the membranes which causes swelling and inflammation. Thus the natural resistance has been broken down offering a harbor for the organisms of the various respiratory diseases that ride on dry particles of dust.

In 1932 a series of experiments was begun by Doctors William S. Kerr and John B. Logan of the University of California based on the premise that the common cold represents a failure of the body to adjust itself to a varying environment. During the course of the experiments, 28 chronic cold sufferers lived in an air conditioned test room and were exposed to methods considered most favorable for the contraction of colds.

None of them did although the only artificial condition they lived under was the air conditioning. During the experiments the room was maintained at a temperature of 70F and a relative humidity of 55%.

A survey in some industrial plants during the winter of 1929-30 showed that 40% of the absences were caused by the common cold. The benefits of air conditioning from this one improvement may be appreciated when it is considered that economists say the common cold costs the American people ten billion dollars a year. It has been observed that the highest pneumonia death rate in industry is associated with dust, extreme heat, exposure to cold and to sudden changes in temperature.

Most factories of necessity are in localities in which there is an abundance of smoke and soot, suspended ash particles, unconsumed hydrocarbon gases, sulphur dioxide gas, and other industrial fumes. Food and water are protected and treated to make them safe for human consumption yet air with its load of contamination is taken into the body as a matter of course. Dusts can produce local disorders like catarrh, rhinitis, bronchitis, or sinusitis by virtue of the mechanical irritation of the membranes, and inorganic particles that are mechanically irritating to the lungs induce attacks of tuberculosis and pneumonia. Pneumonia increases with density of atmospheric smoke regardless of density of population or of poverty.

Asthma is developed in persons sensitive to the dust of pollen, feathers, and fur. One person out of every 100 throughout the United States suffers annually from hay fever, probably no other ailment except the common cold is so widespread. Yet any good air conditioning system which carefully filters incoming air removes most of the pollen. Pollen is 6 microns in size and first class filters are efficient for particles as small as 0.3 of one micron.

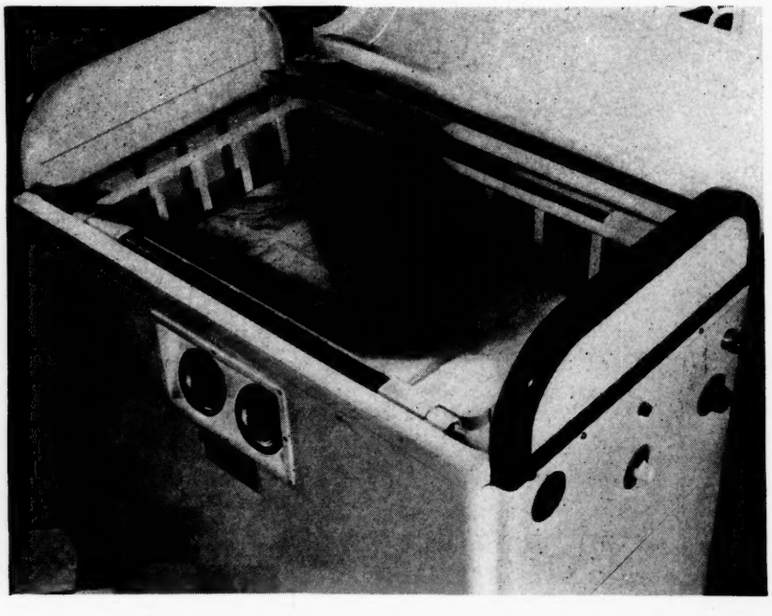
Data on the long time effect of air conditioning on health are lacking because of the newness of the art. It is possible to draw conclusions from observations based on natural climatic conditions. These observations can be divided into two parts, those which concern a whole race in its response to climatic conditions and those which concern the various functional reactions of the individual to meteorological conditions.

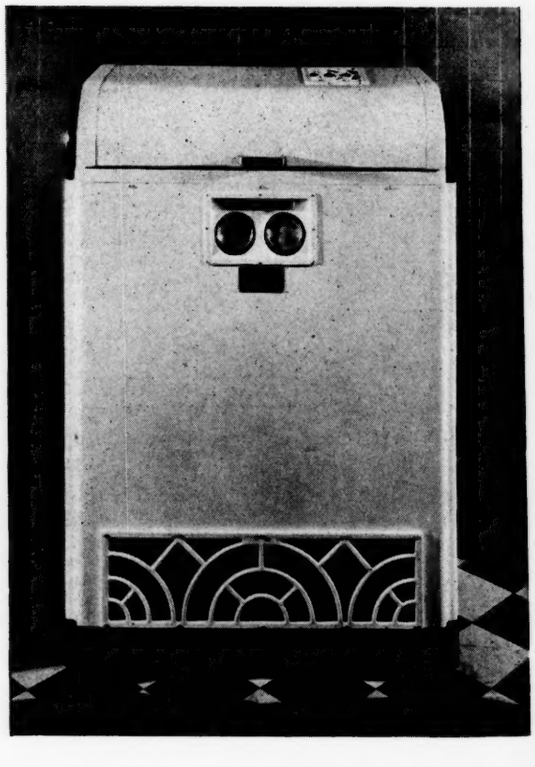
Human life itself may be completely dependent upon proper air conditions. For example, premature infants are kept alive in incubators which are equipped with thermostat and humidistat as well as recorder to verify successful operation of the automatic control. In premature infants the heat loss is greater than normal and the internal heat production is low because the vital organs are not completely developed. The absence of fat deposits under the skin makes it impossible for the infants to maintain a normal body temperature by their own efforts.

Looking at the response of the human system to climates it can be observed that high levels of vitality, energy, and achievement are maintained in the cool, stormy regions of the temperate zone. In the tropics, in the orient, and in our Gulf states there is much less energy available for social or economic advancement. Neither excessive heat nor cold is conducive to achievement and the dominant nations are found where the average temperature is between 50F and 70F.

The actual effects of varying conditions of temperature, humidity and wind movement on the separate chemical, endocrine, and physiological functions of an individual have been shown by Dr. William F. Petersen of the University of Illinois. He offered clinical studies to show the response of the normal, the physically diseased and mentally diseased person to meteorological conditions.

This concludes the series Air Conditioning in Industry.





The importance of proper air conditions to human life is illustrated by the growing use of incubators for premature infants. These two views show one of the latest of such incubators equipped with thermostat, humidistat, and recorder. Photos courtesy Wilmot Castle Co., Rochester. N. Y.

Heating and Piping Contractors Meet in Minneapolis; Elect Porter President

FOLLOWING board meetings and a secretaries' conference, the opening session of the forty-eighth annual convention of the Heating, Piping and Air Conditioning Contractors National Association at the Hotel Nicollet, Minneapolis, May 17, listened to an address of welcome by Thomas E. Latimer, Mayor of Minneapolis. Attendance was most satisfying, with 350 members registered. The remainder of the opening session was devoted to the address of President John H. Zink and to the reports of the secretary and educational director, with an address, "Today's Sales Problems in Our Industry," by J. Lawrence DeNeille.

The morning session of the second day of the convention was devoted wholly to committee reports except for an address on "The Disappearance of Trade and Industrial Skill and Knowledge" by Dr. Charles A. Prosser, Dunwoody Institute, Minneapolis. M. J. Chagnard, reporting for the membership committee called attention to the importance of continued effort to keep members interested and his summary for the year showed that there had been only a slight loss in members during the course of the year just closed. George H. Dickerson, Chicago, reported on the activities of the Plumbing and Heating Industries Bureau by drawing attention to the excellent work being done by the bureau in securing publicity in popular newspapers and magazines. Other reports included those of the legislative committee, by Howard E. Crook, welding committee by F. C. Fantz, committee on certification by T. F. Hanley, Jr., and the committee on standards by George P. Nachman.

With much of the work of the Association conducted by standing committees it was found necessary to devote the third session of the convention to these subjects and during the course of this session Walter Klie reported on trade promotion. George H. Dickerson presided over the forum hour for discussing the problems of distribution facing the contractors. This same session listened to a report presented on the conference committee with the Industrial Unit Heater Association.

Featured in the fourth session was an address, "The New Boom," by B. V. Moore, vice-president, First National Bank and Trust Co., and a report by Pres. Zink on the activities of the Construction League.

At the closing session new officers and directors were elected and were properly inducted into office. New officers and directors are:

President, H. Merwin Porter; vice-president (reelected) George H. Dickerson; treasurer, Frank E. Kise. Directors, Howard E. Crook and William J. Olvany.

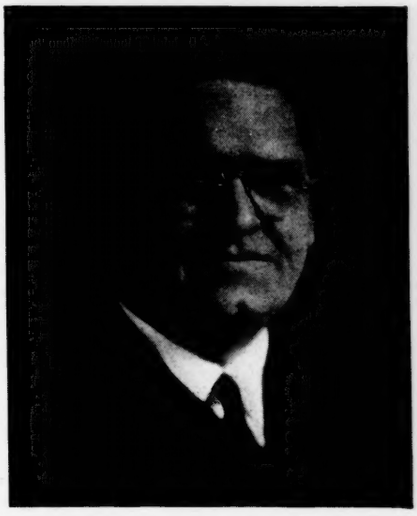
Enjoyable social events were arranged as part of the convention on all days and included a luncheon and floor show, the annual dinner dance, card parties and a fishing trip scheduled for those who stayed over after the convention officially closed.

Of particular interest to engineers and contractors in general was the report of the committee on air conditioning by Mr. DeNeille at the second session. This committee took note of the interest which the mass production and mass distribution manufacturers have taken in the sale of air conditioning equipment. In view of a feeling of apprehension on the part of some contractors, this committee offered several suggestions which were believed to be beneficial to individual contractors. The report stated: "In air conditioning, as in heating, we must decide how we wish to operate. The same methods for obtaining business cannot be used in connection with skyscraper construction as with single family homes in the suburbs. Our first task, then, is to analyze our own particular field and decide what type of business we will try to obtain. After that has been done, the type of organization and the method of handling it can be determined. In this connection your committee suggests for your consideration the following major divisions:

1. Engineered work (involving bidding on plans and specifications prepared by a consulting engineer).
2. Commercial work (involving the promotion of sales to business concerns actuated by the profit motive).
3. The residential field (involving the promotion of sales to purchasers who are actuated by the comfort motive)."

No matter which of these three major divisions is being considered it is necessary to have an organization which can handle engineering, selling, construction, service and management. The volume of work determines whether or not each of these should be a separate department but the work has to go on regardless of the formal organization.

Also regardless of the type of work which any given contractor decides to go after special attention has to be given to organizing a selling force because selling methods differ a great deal depending upon the kind of work to be done. On this point the committee discussed each separately as follows: *"Engi-*



H. Merwin Porter, newly-elected president of the HP & ACCNA.

neered Work. The selling problems in the first classification, covering engineered work involving bidding on plans and specifications prepared by the consulting engineer, are relatively simple and the method is well known to all our larger contracting organizations. The decision of the owner is based on the price quoted plus his knowledge of the ability of the concern to make the installation according to the plans and specifications. The responsibility of the contractor is the same as that which exists in any large heating or piping job, that is, the purchase of materials, the organization of the work and its supervision to insure proper installation. Ordinarily, the contractor who is interested in this type of work will require in addition to his heating organization an engineering force acquainted with air conditioning work and mechanics who are capable of handling cooling installations. If his contract also calls for servicing or for operation, he will need in his organization men capable of performing these services. It is well to note here that it is not unusual to require a contractor to operate a plant for a given period before turning it over to the owner.

Commercial Work. In the second type of work, commercial work involving sales to business concerns actuated by the profit motive, we are dealing with sales which must be developed. These include sales to restaurants, dress shops, beauty shops, drug stores, and other business concerns where the attempt to sell air conditioning is based upon the greater return which the proprietor of the business will receive because of the fact that his place of business is made more comfortable for the customer.

The commercial air conditioning salesman must know something of engineering, but above all he must be a salesman. He should be sales minded, with enough of an engineering background to have a basic understanding of the subject. He must have facts to back up his sales arguments, must be able to show the owner of the commercial establishment dollars and cents advantages and must be able to demonstrate that air conditioning will pay for itself.

This type of work must be sold through specialty selling methods. It requires a different type of selling organization from that by which we get business through estimating on designed jobs. It is necessary to have for this work salesmen who will visit the prospect, create in his mind the need for the installation and then proceed to sell the air conditioning installation.

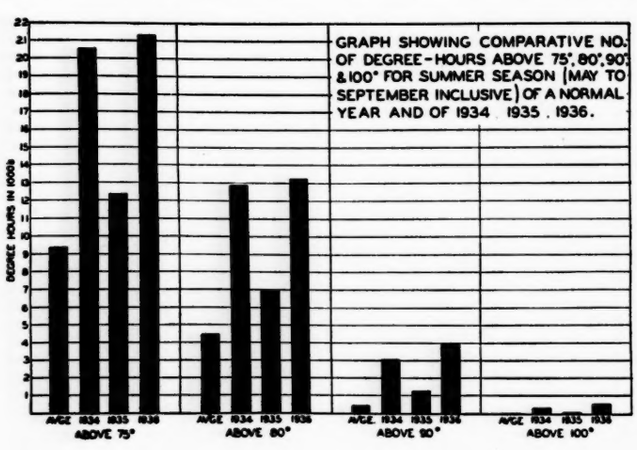
Residential Field. The sale of work in the third classification, the residential field where purchasers are actuated by the comfort motive, likewise calls for specialty selling methods. The same type of selling and engineering organization is needed here as is needed in the promotion of sales to business concerns. The selling appeals used by the salesmen are, however, very different. Here we are concerned with selling comfort rather than larger profits. Sales in this field can not be made by selling compressors, filters, air washers and automatic controls. First, comfort must be sold and after that has been accomplished we are in position to select the equipment which will produce the desired comfort. Do not make the mistake of reversing this process.

The salesman of air conditioning in the home field must be of the imaginative type. He must be able to show the advantages of air conditioning from a physical standpoint. He must be able to vividly portray the discomfort of the summer contrasted with the comfort that goes with air conditioning."

The date and location of the next convention have not yet been announced.

Summer Degree-Hours for Omaha, Neb.

THE accompanying graph as published in "The Business Conditioner" shows the last three summers, 1934, 1935 and 1936, compared with a normal—or average—year, chosen from records of the U. S. Weather Bureau dating from 1871 to 1934, inclusive. The unit of comparison in this chart is the degree-hour excess over a specific base temperature.


GRAPH SHOWING COMPARATIVE NO. OF DEGREE-HOURS ABOVE 75°, 80°, 90° & 100° FOR SUMMER SEASON (MAY TO SEPTEMBER INCLUSIVE) OF A NORMAL YEAR AND OF 1934 1935 1936.
DEGREE HOURS IN 1000s
AVGE 1934 1935 1936
ABOVE 75°
AVGE 1934 1935 1936
ABOVE 80°
AVGE 1934 1935 1936
ABOVE 90°
AVGE 1934 1935 1936
ABOVE 100°

The year 1936, on the whole, was slightly hotter than 1934. May and June of 1934 exceeded those months of 1936, but July, August, and September of 1936 broke a number of all-time records and brought the total degree-hours of excess heat for 1936 above that of 1934.

In July, 1934, 90F or above was reached daily for 18 consecutive days. For 402 hr. during this period, the thermometer did not drop below 75F. The year 1936 chalked up 34 consecutive days when 90F or above was reached (the last six days of June and the first 28 days of July). The same year brought a new all-time high of 114F on July 25. Four times during July and August of 1936, the thermometer recorded 110F, and for two weeks, July 13 through 19 and from August 12 through 18, temperatures of over 100F were recorded each day.

The record low for humidity was established on July 6, 1934, when the temperature was 110F and the relative humidity only 10%.

From the chart, it is seen that June, July, and August are always hot in Omaha and summer air conditioning must extend from May through September.

EDITORIALS

Degree of Responsibility

In sentencing the six men found guilty of second-degree manslaughter in connection with the collapse of an apartment house in New York last summer, with the death of 18 workmen resulting, a county court judge is reported to have made a statement which seems rather startling from an engineer's point of view. Those convicted included two owners of the building, which was under construction when it crashed, a masonry contractor, a city masonry inspector, an architect, and a city building plan inspector.

The first four received sentences ranging from two to five years, while the architect and plan inspector were given suspended sentences since, according to the judge's reported remarks, these men had since lost their jobs and *neither of them had seen the actual building.*

Any heating or air conditioning engineer who has been forced to design a system for a building from the sketch plans often available will heartily agree with the idea that one who does not see the actual building is not so fully liable as those on the job. Nevertheless, the judge's remarks make one wonder if contractors working from supposedly approved plans are more responsible than architects and engineers.

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New Approach to Silicosis Problem

Removal of silicosis-producing dust from air or protection of the worker from the dust-laden air has come to be considered as the principal means of preventing silicosis. Now comes the revolutionary suggestion that it may be possible to accomplish something of the kind by introducing still more dust into the air. The idea, backed by some research work at one of the large universities, is that certain chemicals such as carbon black and iron oxide in dust form may be made to attract the silica particles and facilitate their removal from the lungs or prevent their lodging in the lungs. Our information contains no intimation that such a process is now more than a hope, but it does show that even a field considered as stable as that of the practical ways of approaching the silicosis problem cannot be considered wholly closed to new developments.

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To Prevent Disasters

Last month we published the letter of the head of the Bureau of Mines to the Texas governor regarding the disastrous school explosion last March. Along with six findings of fact as to the cause of the disaster, ten recommendations were also appended designed to prevent similar happenings in the future. Coming from fuel utilization specialists these recommendations should receive thoughtful attention from all those who either design or operate schoolhouse plants, or plants in any building where crowds assemble. No one at all familiar with practice in such buildings can help but note from a careful reading that there are few if any buildings where at least some of these recommendations are not flagrantly violated. Still the recommendations do not seem especially onerous, severe, or generally anything more than ordinary prudence would require. Some might cost a little more than present practices to be sure but one disaster is worth a lot of money to those who lose children through one of them. The designer and operator both have a grave responsibility in all such buildings and neither has any right to take chances, although both are almost always hampered and frequently completely handcuffed by the necessity of staying inside an arbitrarily determined cost limitation and still meeting rules of procedure laid down for them. Merely drawing up rules of procedure is not enough. The rules must be based on something real and they must give the designer and operator both room to move and an incentive for doing their best, while insuring the safety of the occupants. This is no small order, but worse problems have been faced and solved. There are now many models in existence on which to pattern whatever changes are necessary in order to bring schoolhouse plants everywhere fully into line with the latest and safest practices. The problem is more due to a lack of the will to proceed rather than to any other one element. We in this industry naturally cannot supply all the will power necessary but we can do a good deal by continually urging the importance of good, sound engineering in all the details of heating and ventilating plants in all kinds of public buildings.

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New Local Codes

Wisconsin has been a leader among the states for a long period in the nature and completeness of its code governing the installation and operation of heating and ventilating plants. In this issue we present in full a new code drawn up by a private group of engineers interested in seeing a clarification of the factors governing the design of air conditioning installations. While not a part of the state code and not to be confused with it, the new rules appear to have gone farther than other recent codes on the subject in the detail with which they specify certain of the items. A thoughtful reading of the code is suggested even though it is now without official status.

These sectional codes are likely to continue to appear for some time and will doubtless influence later enactments almost certain to come as air conditioning keeps on growing. They also represent attempts to systematize and clarify a situation which has been confusing to an alarming degree in some localities. Our thought in this connection is that voluntary action by interested engineer groups is about the only way to get things started. We believe that in any locality, be it state or city, where this confusion exists any code is better than no code at this stage. We hope that the action of the Chicago group and the Wisconsin group will be substantially repeated elsewhere.

ABSTRACTS of Current Papers, Books and Pamphlets

Plumbing Engineering

Plumbing engineering is a subject which has been rather neglected by technical writers and publishers. For some reason books on the engineering of plumbing have been few and far between and any book that covers the field even reasonably well is to be welcomed.

The author has done an excellent job in the preparation of this book. He has prepared and has followed a good outline and covers the field of plumbing in a thorough manner. He has also included brief explanations of the fundamentals of subjects of secondary interest to plumbing engineers such as refrigeration, heating, ventilation, and air conditioning.

The book begins with the preliminary studies of water supply and continues with sewage treatment or sewage disposal from a building or group of buildings. For buildings in suburban districts the subject of water supply is taken up with the tap in the city main, follows the house service supply lines to the fixture and thence back as sewage through the soil and drain lines and house sewer to the public sewer. For rural buildings the water supply is assumed to be taken from a well, spring, or surface supply, is followed through the main or buildings as described above and ends with the disposal of the sewage in a river or other suitable body of water, or by sewage treatment or by a combination of both.

The author has tried to introduce a sufficient study of hydraulics and pneumatics to make clear why pipes and accessories of certain capacities and quality are required to take care of peak loads of water supply and sewage. Requirements of The National Board of Fire Underwriters are given for pipe and sprinkler systems so that the reader may compare the results obtained in the laboratory with practical requirements. Reference is made to bacteriology and chemistry in discussing water for potable and industrial purposes. To a considerable extent the problems encountered in practice have been used to illustrate the work.

A list of the chapter headings follows: Water, Its Effects on Plumbing; Hydraulics and Pneumatics as Encountered in Plumbing; Chemical Actions; Water Supply and Consumption: Pumps for Water Supplies, Sewage and Drainage; The Water Supply Piping of Buildings; Meters and Their Application; Types of Tanks; Distribution Systems; Removal of Sewage from a Building; A Discussion of Contract Documents and Specifications; Private or Independent Sewage Plants; Auto Refrigeration; Modern Drinking Water Systems;

Residential Air Conditioning

THIS book is intended not only as a work of reference for engineers and architects responsible for air conditioning installations, but it is also for all homeowners contemplating the installation of air conditioning systems. It explains the important advantages of air conditioning, the fundamental principles involved, the air conditioning equipment and systems in use, and includes an unusual amount of definite data for everyone interested either in partial or complete air conditioning.

The exact procedure in designing typical installations is shown by specific examples, and there is a vast amount of practical designing data and general information of an original character. Simple drawings or diagrams, many of which fill an entire page, show the arrangement of different systems and illustrate just how different classes of air conditioning apparatus may be combined with existing heating systems. The advantages and disadvantages of different systems are pointed out.

The important question of cost is carefully considered; in fact, this is one of the unusual features of the book. This information on cost applies to various types of air conditioning equipment, and typical cost figures are given in a series of tables which include important units, such as steam and hot water boilers, gravity and forced warm air furnaces, conversion burners, humidifiers, unit room coolers, fan-filter and fan-washer units, refrigeration units, attic and kitchen fans, and automatic controls.

The first two chapters deal with the benefits, effects, and functions of air conditioning; chapters III and IV describe in detail various types of air conditioning equipment and systems; installation and operating costs are found in chapter V; chapter VI contains a series of 90 questions and answers relating to the principles of air conditioning.

The psychrometric tables in chapter VII are another special feature. These tables, which occupy 38 pages, give, in convenient form, data showing the relations between wet-bulb and dry-bulb temperatures, saturation temperatures, moisture contents, and similar properties of air. The following chapter explains the use of these tables and contains 39 practical examples with their solutions.

Then follows chapters on heating calculations, cooling calculations, the design of the air distribution system, and notes on equipment selection. The Standard Code for the design of mechanical warm-air systems is included, and also a useful table of conversion factors. Most of the book is written in non-technical language so that anyone not engaged in actual designing or installation problems may, nevertheless, acquire a large amount of useful timely information.

[*"Air Conditioning in the Home," by Elmer Torok. Published by The Industrial Press, 148 Lafayette St., New York. 296 pages; 6 x 9 in.; 50 illustrations; 45 tables; price, $3.*]

Water Purification; The Plumbers' Craft in the Summer Camp; Heating and Ventilating, Air Conditioning; and Estimating.

[*"Plumbing Engineering," by Water S. L. Cleverdon. Published by Pitman Publishing Corp., New York. Cloth cover, 6 x 9 in., 445 pages; price, $3.50.*]

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Air Conditioning Blue Book

There are three main sections in this book—a technical reference data section, a classified directory of heating and air conditioning equipment manufacturers, and an advertising section.

The technical reference section is a collection of tables, charts and papers from a wide variety of sources. An excellent job has been done in collecting these data although it is to be regretted that more effort was not applied to classify the material. To show the large variety of material which has been brought together in this section a few of the titles of the charts and tables are listed: psychrometric chart; air distribution charts; comparative properties and refrigerants; coefficients of heat transmission; economical steam pipe sizes; fan and duct design; and air conditioning with well water.

The classified directory section is probably one of the most complete which has been published to date. It is divided into three parts, the first listing manufacturers by equipment; the second, manufacturers by trade name; and the third the names and addresses of the various manufacturers.

[*"Air Conditioning Blue Book," published by Domestic Engineering Co., 1900 S. Prairie Ave., Chicago. Fabricoid cover; 8½ x 11 in.; 539 pages including advertising section; price, $3.*]

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Brief Reviews

FAN CLASSIFICATION. Illustrates and describes standard methods of designating discharge, rotation and arrangement of drive of centrifugal fans. Information has been conveniently classified and may be inserted in a standard three-ring binder for ready reference. [*"Designation of Fans," prepared by the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit, Mich. One page, 8½ x 11 in.*]

CARBON DIOXIDE DETERMINATIONS. Describes the construction of a hand-operated apparatus for determining the carbon dioxide of air when the concentrations range from 65 to 125% of that of ordinary air. Two to three determinations can be made each hour with a maximum error of 2%. Except for one or two parts the apparatus is constructed from standard laboratory equipment. It employs the electrical conductivity principle. [*"Precise Determination of Carbon Dioxide in Air," by J. G. Waugh Published in Industrial and Engineering Chemistry, February 15, 1937; pages 96 to 100.*]

ABSORPTION AND EXTRACTION. The purpose of this book is to outline the underlying theory of such important diffusional processes of the unit operations of chemical engineering as absorption and extraction. The book may be divided roughly into three parts: the theoretical aspects of diffusion and the underlying theory of the design of absorption equipment; a summary of the available performance data on various types of equipment; and the basic principles of solvent extraction. [*"Absorption and Extraction," by Thomas A. Sherwood. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York. Cloth bound, 6 x 9 in., 278 pages; price, $3.50.*]

HEATING AND VENTILATING CHARTS. Three large-size charts for the quick calculation of piping and duct sizes. Charts are based on the result of investigation by J. Nikuradse. First chart covers warm water and duct heating, second covers low pressure and vacuum steam heating, while the third deals with air heating and ventilating systems. Text in German. [*"Rohrleitungen von Heizungs-und Luftungsanlagen," (Conduit of Pipes for Heating & Ventilating Systems). Three charts in paper folder; price, RM 4.80 ($2).*]

BRITISH PHYSICAL LABORATORY REPORT. Report for the year 1936 of the National Physical Laboratory of the Department of Scientific and Industrial Research. Included are reports on investigations conducted on the following subjects: specific heats of gases at high temperatures; thermal conductivity; evaporation of water from moistened surfaces; viscosity and vapor pressure of brines; temperature measurement; noise measurement; acoustics of buildings. [*"The National Physical Laboratory Report for the Year 1936," obtainable from the British Library of Information, 270 Madison Ave., New York. Paper cover, 6 x 9 in., 144 pages; price, 80c.*]

BOILER WATER AND CONDENSER LEAKAGE. Describes a new electrometric procedure for measuring carry-over of liquid water into the steam lines from a boiler and the contamination of condenser water by leakage. Method requires comparatively inexpensive apparatus and is said to be accurate and rapid. [*"Foaming and Priming of Boiler Water and Condenser Leakage," by Richard Ulmer. Published in "Industrial and Engineering Chemistry," April 15, 1937; Vol. 9, No. 4; pages 172 to 174.*]

HEAT TRANSFER IN BOILERS. A book written for the engineer interested in the design of large boilers. Purpose is to bridge the gap existing between the highly technical theories of heat transfer and practical design. The author attempts to develop a sound logic, free of intricate formulas, which will give the answer to important questions on the subject of heat transfer in boilers. A large amount of actual boiler data is presented to substantiate the logic developed. [*"The Simple and Direct Answer to All Problems of Heat Transfer in Boilers," by Lloyd R. Stowe. Published by Stobond, 719 Linden Ave., Wilmette, Ill. Paper cover; 8½ x 11 in.; 90 pages; price, $3.*]

WHAT READERS SAY • • •

ASTM Specifications

[In reference to the American Society of Testing Materials Specifications for pipe, tubing, sheet and gray-iron castings†] . . . Several of the specifications were revised or adopted as standard by the Society last year and in these cases the designations have accordingly been changed. The standard specifications for welded and seamless steel pipe were revised last year and the current designation is A 53-36. The tentative specifications A 120-32 T were also adopted last year and now are designated A 120-36; likewise the tentative specifications A 48-32 T were adopted and carry the current designation A 48-36. . . . You may also be interested in a change in title of A 93-27 which now reads "Standard Specifications for Zinc-Coated (Galvanized) Iron or Steel Sheets."

It may be that in preparing this list of specifications reference was made to an early edition of ASTM standards and tentative standards. There have been a number of additional specifications for pipe, tubing, sheet and gray-iron castings issued by the Society in the last two years and since certain of these may be of interest . . . I think it would be desirable to mention these at this time should you wish to add any to your list. . . .

Tubing—In addition to B 68 the Society has also issued standard specifications for copper water tube (B 88-33) and for seamless copper tubes (B 75-30).

Sheet—The standard specifications for zinc-coated (galvanized) wrought-iron sheets (A 163-36), adopted by the Society last year, may also be of interest, as well as the standard specifications for uncoated wrought-iron sheets (A 162-36). The Society has also issued standard specifications for zinc (hot-galvanized) coatings on structural steel shapes, plates and bars and their products (A 123-33) and tentative specifications for zinc coating (hot-dip) on hardware and fastenings (A 153-33 T). . . .

Gray-Iron Castings—In addition to A 48 and A 126 there are also available two other specifications for gray-iron castings, namely, the tentative specifications for automotive gray-iron castings (A 159-35 T) and for lightweight and thin-sectioned gray-iron castings (A 190-36 T).

AMERICAN SOCIETY FOR TESTING MATERIALS
Philadelphia, Pa. P. J SMITH,
Technical Assistant

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Professional Engineers

I read with much interest your article which appears in the April issue of HEATING & VENTILATING in reference to the New London, Tex., school disaster, particularly as it expresses very closely my thoughts which I made in a letter to the editor of the *Cleveland Plain Dealer* written on the day after this terrible catastrophe . . . I am attaching a clipping of this article . . . I am strongly in favor of working for better engineering design and inspection enforcement in connection with our school construction as well as other public buildings.

MAYER & VALENTINE F. H. VALENTINE
Mechanical Engineers, Cleveland.

[Mr. Valentine's letter from the *Cleveland Plain Dealer* follows.]

It is with horror we read in the press of the great school explosion and disaster at New London, Tex., and it is still more saddening when we realize that this catastrophe no doubt was caused perhaps by improper design of the heating plant and its installation; improper from the point that the natural law of ventilation was ignored.

I note that the school building was heated by means of gas steam radiators, probably selected for the reason that gas in that district was the cheapest fuel available. The question is, was the heating system as a whole properly installed and vented?

Probably not, in my opinion, or the accumulation of gas sufficient to cause this horrible explosion would not have occurred. Gas steam radiators as mediums of heating are proper. However, I do contend that if they are not properly installed and properly engineered as a complete system that they are dangerous.

Most states today have enacted laws requiring such engineering design to be prepared and supervised by qualified registered professional engineers. In some states these laws are rigidly enforced, in others not, and in such, this condition should not be tolerated by the public. Such school disasters as this in New London are usually the result of lack of enforcement.

In Ohio we have a law which reads in part: "That in order to safeguard life, health and property, any person practicing or offering to practice the professions of engineering shall be required to submit evidence that he is qualified so to practice and shall be registered; and it shall be unlawful for any person to practice or to offer to practice the professions of engineering in this state, unless such person has been duly registered."

The practice of professional engineer within the meaning and intent of this act includes professional service such as design and responsible supervision of construction or operation in connection with any building wherein the public welfare, or the safeguarding of life, public health or property is concerned or involved.

This is a good law but will be of no benefit to the public if not enforced. At present I regret to state, in my opinion, this law is not fully enforced, as design work is being done and doubtless will be done in the future to a greater or less extent by persons, firms or corporations who are manufacturers, material sales agencies or contractors and who are not registered engineers.

†Mentioned on page 53 of the March, 1937, issue of HEATING & VENTILATING.

Let us hope that we, the people of Ohio, do not have to experience such a horrible death catastrophe as this to awaken us to the necessity of action.

To correct such a condition it seems to me that we should immediately enact a law to strengthen our present good law and this in substance should be enacted somewhat as follows:

No person, firm or corporation who furnishes and/or installs systems or parts thereof of heating, ventilating and piping systems in connection therewith in any building is permitted to prepare plans and/or specifications or render any engineering service for bringing about the sale of any equipment, appurtenances and piping systems in connection therewith unless said persons are duly qualified registered engineers, and further to require supervision of such work by a registered engineer and requiring certification by that registered engineer as to the adequacy of the plans and the completeness of their execution before a certificate of occupancy can be issued.

I feel that if serious thought is given to these conditions, then we will be going a long way to prevent further catastrophes to our school children. — *F. H. Valentine.*

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"Split" Systems

I thought you would be interested in the enclosed newspaper release on the "split system," inasmuch as I have adhered to the old definition of the "split system" as set forth in your editorial, "What Is A 'Split System' Now?" in the December issue of HEATING & VENTILATING.

Apparently there is a lot of confusion in the industry today as to how the term "split system" should be used. For instance, I note that on page 42bt of the March, 1937, issue of [an architectural publication, the author] says: "There is a split system of air conditioning, whereby the bath, the kitchen, and the garage are heated with radiators, whereas the rest of the house is fully air conditioned."

I quite agree with the thought you express in your December editorial when you said that the term "combination system" should be used to describe an installation which heats part of the house by central air and part by direct radiation.

One is tempted to pun and say that "the industry is split on the split system."

PLUMBING AND HEATING INDUSTRIES BUREAU, Chicago. NORMAN J. RADDER.

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Keep Records!

Knowing as we do the cost of the steam, electric, and water services to hospitals, institutions, schools, etc., it would seem to us that the results obtained at one of the larger hospitals here in Boston would be of interest to others.

Without the addition of any labor saving devices or any expensive controls or systems, a very substantial saving in the cost of operation has been made by proper organization, records and persistent care and attention to the small details that many times do not seem at all important.

This particular hospital has a boiler plant consisting of three 66-in. H.R.T. brick-set boilers fired with steam atomizing burners, hand controlled. The boilers and settings are comparatively new, but the burners and oil equipment have been in use a long time.

In 1931 all the pumps were overhauled, repiped, and a new motor-driven sump pump was installed. A steam flow meter and water meters on the make-up water to boilers and the hot water flow pipes to the laundry, etc., were installed.

About this time, one of the trustees inaugurated a regular weekly inspection covering at least one building and the central plant, collecting all necessary records and data to enable him to check work done and costs of same. The building inspection covered all leaky fixtures, traps, plumbing and electric services with careful attention to any possible waste. Any defects noticed were recorded and repairs made as promptly as possible.

In connection with the water service, the records soon indicated where the greatest use of water occurred and the reason for this use was ascertained. It was discovered that five separate meters were in use with five separate bills. As all buildings were connected by tunnels the city department's bills were then based on one meter giving the lower rates possible under the sliding scale. At the end of about a year the water bill was reduced over $3500 without in any way restricting the legitimate use of water.

In connection with the steam service careful records kept over a period of approximately three years indicate clearly where the steam is used, where wastes can be eliminated and due to the standards set, the boiler room force has improved its routine so that although the hospital is now caring for approximately one third more patients, the total fuel cost has decreased although the oil cost per gallon has increased from 3 cents to approximately 3¼ cents.

In connection with the electric work, certain motors have been changed, the hours of operation of a motor generator set reduced and a continuous study has been made to save wherever possible.

The actual cost per patient day for heat, light, and water has been reduced approximately 30% and the service has been decidedly improved.

In addition the hospital now has a set of records that set certain standards showing just what proper operation requires and the comparison of each day or week's records show very plainly whether the operating force is doing its work properly.

If any serious variation occurs, some one has to explain why and corrections are made without delay.

The standards set here are high and constant care and attention is needed to maintain all parts of the equipment. The result is that cleanliness, no leaks, prompt repairs and cooperation with very little new equipment and no complicated systems has reduced the cost of operation approximately $10,000 per year.

RICHARD D. KIMBALL CO., Engineers, Boston, Mass. C. W. KIMBALL

NEWS OF THE MONTH

Future of Anthracite Discussed At Industries Conference

NEW YORK—The complete program of Anthracite Industries, Inc., was presented in speeches, demonstrations, and graphic and dramatic presentations April 26 at the Hotel Commodore here in the first conference put on by that organization since its formation. Frank W. Earnest, Jr., president of Anthracite Industries, Inc., presided and was assisted by the executive staff.

More than 600 leaders of the anthracite industry and allied business groups were in attendance. Anthracite operations companies, their sales agencies, manufacturers of anthracite-burning equipment, retail dealers associations, chambers of commerce in the anthracite region, were practically all represented by their presidents and other executive officers.

The program of the day was a dramatized presentation of the plans to regain markets for anthracite through the sale of modern heating equipment and was received with enthusiasm.

Speakers included Arnold Michelson, vice-president, Minneapolis-Honeywell Regulator Co., who discussed the value of thermostatic control for anthracite equipment. Allen J. Johnson, director, Anthracite Industries Research Laboratory, Primos, Pa., presented the enlarged program of the laboratory. A. F. H. Scott, Anthracite Industries staff, outlined new developments in the equipment field. Bruce Wilson, FHA director of education, presented a report on the rapid growth in new home construction, and in home modernizing with Federal financial assistance, indicating a growing market for more modern anthracite equipment.

Arthur R. Herske, vice-president and general sales manager, American Radiator Co.; Joseph C. Fitts, executive secretary, Heating Piping & Air Conditioning Contractors National Association; Homer Addams, president, Steel Heating Boiler Institute; and Cy Burg, vice-president and general sales manager, Iron Fireman Manufacturing Co., each speaking for the equipment industry which he represented, gave support to the program of Anthracite Industries, outlined the cooperation and support being given by the equipment companies, and predicted large-scale results.

The field staff of Anthracite Industries, which now numbers 26 with steady growth that will soon result in a field group of over 35, was introduced to the conference by Ernest E. Finn of the Industries headquarters staff. Several members of the field organization took part in the day's program, including Thomas F. Lennon of Milwaukee, Wis., who reported on anthracite progress in the western markets. Others presented plans and demonstrations of campaigns for the sale in large quantities of automatic-control water heaters, and modern anthracite space and circulation heaters.

James P. Duffy, executive assistant of Anthracite Industries, presented the ambitious advertising plans of the organization, and G. Gordon Cook, secretary and treasurer, reported on the results of the 16 demonstrations already presented in various cities by his organization, and presented the plan for future exhibiting.

Tiltz Forms A.C. Firm

HARTFORD, CONN.—Tiltz Eastern Air Conditioning Corp. has been chartered here under Connecticut law with authorized capitalization of $50,000, of which $3000 is paid in at start of business. Offices are at 36 Pearl St. Bernard E. Tiltz of Larchmont, N. Y., is president and treasurer, and Winston B. Brown and John C. Roach, both of Hartford, are vice-president and secretary, respectively. The officers are also directors.

Graveyard Gang Glorifies Gas for Glib Gazette

TOLEDO — Surface Combustion Corporation of this city publishes a monthly house organ known as *Janitrol Journal* which has a wide circulation among those interested in gas heating. News items in the journal are obtained from approximately 80 correspondents who are employes of gas companies throughout the United States. To induce them to send in items a special monthly mimeographed bulletin called "Flash" is sent to them by L. C. Kerrick, Journal editor. The "Flash" is usually along humorous lines and the April 15 issue contains the results of a survey by the "Journal Research Department" which follows:

The health argument is unquestionably a very important one in selling gas heat. When it comes to estimating health advantages, there is just one accurate yardstick and that is whether or not a man is alive or dead. If he is living, then he hasn't any kick coming . . . if he is dead, then the only thing to do is to find out what made him die. Knowing that, we know all.

In that characteristic way all engineers have of going into things from a scientific standpoint, we took advantage of the fact that the large Calvary Cemetery is located just opposite the Janitrol factory.

The survey covered approximately four weeks' time and can be broken down into the following component parts: (1) Two weeks' time spent in making a tabulation of all names on the tombstones in the cemetery; (2) One week's time investigating the corresponding death certificates on file at the court house so as to determine the cause of death: (3) One week's time investigating the former homes of the cemetery occupants so as to find out what kind of heating system they had been using.

The results were most sensationally amazing. Out of 14,783 names, only one had been using gas heat, indicating that all other gas heat users are still living. At first, we were somewhat disheartened over finding that solitary one, but further investigation showed that at the time of his death, the man was 96 years old and, right up to the moment of his death his health was perfect . . . so perfect in fact that the old fellow had been out to two night clubs and was pretty well ossified. On his way home along about 3:00 a.m. he saw one of those big 10-ton trucks from Detroit and concluded to kick it off the street. It got the best of him but not until he had broken off the front bumper, flattened two tires, drunk about a gallon of the gasoline, and knocked out the driver's teeth. The coroner said that even then he would doubtless have recovered if they could have gotten him into his gas heated home quick enough.

March Building Contracts

NEW YORK—March construction in the 37 eastern states totaled over $231 million according to F. W. Dodge Corp. In February the figures was $188 million while for March, 1936, the total was $199 million. Of the March, 1937, figure $90 million represented residential building; $89 million went for non-residential building, and $52 million went into heavy civil engineering projects.

The March residential total was about 65% ahead of the total of $55 million reported for March, 1936.

Residential building gains over March of last year were shown in each of the major geographic districts without exception. The most important increases occurred in the Chicago territory, southern Michigan, New England, southeast, and in the Pittsburgh territory.

Non-residential building gains over a year ago, where they occurred, were largely in private as distinguished from public jobs.

Swampscott Convention Plans Complete

NEW YORK—Everything is in readiness for the 1937 semi-annual meeting of the ASHVE, which will be held at the New Ocean House, Swampscott, Mass., June 24-26. Massachusetts chapter members have planned a splendid program and hope that those who attend will enjoy the hospitality of New England, its picturesque scenery and its many historical points of interest.

W. T. Jones, chairman of the committee on arrangements, reports that his committee has planned entertainment for everyone who attends the summer meeting. For those who play golf there will be a kickers handicap and a tournament for the research and chapter cups at the Tedesco Country Club, which is situated within a mile of the hotel. On Thursday afternoon, the ladies and members who do not play golf will enjoy a boat trip to Gloucester, and in the evening the banquet and dance will be held. A New England shore dinner will be served.

Morning sessions will be held on Thursday, Friday, and Saturday at 9:30 a.m. (daylight saving time) and the technical papers will include discussions of air conditioning system operation, the use of pre-cooling coils.

Members of the committee on arrangements assisting Mr. Jones, are Alfred S. Kellogg, registration and reception; James Holt, entertainment; J. F. Tuttle, golf; T. F. McCoy, transportation; R. M. Nee, publicity, and W. E. Barnes, finance.

The technical program follows:

JUNE 24
9:30 a.m.

Adaptability of Pre-Cooling Coils to Air Washer Systems, John Everetts, Jr.

How Much Power Will an Air Conditioning System Use?, A. D. Marston.

Study of Summer Cooling in the Research Residence Using Water at Temperatures of 52 and 46F, A. P. Kratz, S. Konzo, and E. L. Broderick.

Report of ASHVE-ASRE Committee on National Standards for Air Conditioning Applications, L. A. Harding, chairman.

JUNE 25
9:30 a.m.

Ventilation Requirements, Part II, C. P. Yaglou and W. N. Witheridge.

Calculated Over-All Coefficients for Walls with Air Space Insulations, F. B. Rowley.

Performance of Fin Tube Units for Air Cooling and Dehumidifying, G. L. Tuve and C. A. McKeeman.

The Cooling and Heating Rates of a Room with Different Types of Steam Radiators and Convectors, A. P. Kratz, M. K. Fahnestock, and E. L. Broderick.

JUNE 26
9:30 a.m.

An Alternate Method of Comparing the Dust Arrestance of Air Cleaning Devices, Arthur Nutting.

Direct Reading Effective Temperature Indicator, J. R. Parsons.

Corrosion Studies in Steam Heating Systems, R. R. Seeber and Margaret R. Holley.

Heating Requirements of an Office Building as Influenced by the Stack Effect, F. C. Houghten and Carl Gutberlet.

Sturtevant Completes 7000 R.R. A.C. Units

BOSTON—Completion of the seven thousandth railway car air conditioning unit was celebrated recently at the Hyde Park plant of B. F. Sturtevant Co. A group of officials of the company watched the unit come off the assembly line, marking a milestone in the history of air conditioning since the company introduced its first railway air conditioning equipment in 1910.

Technical and Business Program of Warm Air Meeting

COLUMBUS—Allen W. Williams, managing director of the National Warm Air Heating and Air Conditioning Association, reports that preparations are proceeding satisfactorily for the summer convention of the Association, which is to be held in the Hotel Cleveland, Cleveland, Ohio, June 8 to 10. The program, recently released, follows:

JUNE 8

10 a.m.

Board of Directors meeting.

Installation Codes Committee meeting.

2 p.m.

Research Advisory Committee meeting.

Technical Educational Committee.

JUNE 9

9:30 a.m.

Address by President W. L. Rybolt.

F.H.A. Activity in Connection with Homes for People in the Lower Income Brackets, by A. O. Eberhart, special assistant to the FHA administrator.

Balancing the Job, by D. O. Price, Toronto.

Humidity and Its Problems, by Prof. L. G. Miller, Michigan State College.

Corrosion of Air Conditioning Ducts, by F. H. Ramage, Cleveland.

Merchandising Our Products for a Profit, by Nelson B. Delavan, Des Moines.

2 p.m.

Research Advisory Committee Report, F. C. Sedgwick, chairman.

Results of the Investigation of Summer Cooling in the Research Residence, by Prof. A. P. Kratz, University of Illinois.

Two Speed Control System for Fan Operation, by S. Konzo, special research associate, University of Illinois.

JUNE 10

9:45 a.m.

Our New Technical Mechanical Installation Code, by Prof. J. D. Hoffman, Purdue University.

Electric Motor Design and Application, by J. A. Rodgers, St. Louis.

A dinner and aquacade at the Great Lakes Exposition will be held at 6 p.m. on the evening of June 9. Included with the tickets for dinner will be admission to "Streets of the World." On the afternoon of June 10 the golf tournament will be held at the Westwood Country Club.

Boston Edison Starts A.C. Campaign

BOSTON—An advertising program in the interests of the air conditioning industry has been started by the Edison Electric Illuminating Company of Boston, with advertisements to run for five weeks in a weekly series through four leading Boston business publications. Each of the advertisements has a different striking head and a paragraph quoting some prominent business user of air conditioning on the effects upon his business, together with an inquiry coupon which will bring a representative of the utility's air conditioning division to talk over matters with the prospect and advise him. The inquiry and data thus obtained are thrown open to air conditioning firms for negotiations or competitive bidding direct to the customer. The Edison company stresses in its advertising that it has no equipment to sell, but acts solely to assist and advise the customer in his problem.

Houston Has 400-Ton A. C. Installation

HOUSTON—During March, 576 tons of air conditioning installations were installed in this city, according to the Houston Light & Power Co. The largest single job was the Second National Bank Building with 400 tons.

Air Conditioning Booming in Dallas

DALLAS—The southwest, with its abundance of raw materials available for proper insulation, is one of America's most fertile fields for air conditioning sales and for the manufacturing of conditioning equipment, according to a recent survey of Harold M. Young, North Texas and Oklahoma district manager for the Bureau of Foreign and Domestic Commerce.

Interviewed in his Dallas headquarters, Mr. Young outlined the advantages industrial air conditioning would give this area with its cheap labor.

Looking ahead to the point when Texas materials, including sheetrock and sugar cane fiber, will supply all its insulation needs, the Carraway-Byrd Corporation of Dallas has purchased a seven-story factory building for manufacturing a general line of air conditioning equipment for distribution through this area. Officials of the company plan a steady increase in the factory's output and range of its activity.

Dallas' two largest hotels now are having installed $350,000 worth of air conditioning equipment in their guest rooms. The larger job is at the Baker Hotel where a $200,000 central system with individual thermostatic room control is being installed, as designed by Kribs and Landauer, Dallas engineers. They also are handling jobs on the Gunter Hotel, San Antonio, El Hardin, Brownsville, in Texas, and several in Oklahoma.

The Hotel Adolphus is conditioning 300 of its 825 rooms. Its equipment includes six compressors, the total output of which will be six hundred tons, one of the largest in the southwest. The Wallace Plumbing Co. is the local contractor and the plans and specifications were drawn by Warren D. Lewis of New York.

Both the Baker and Adolphus have rushed installation of their jobs to be ready for the June 12 opening of the Greater Texas and Pan American Exposition in Dallas. Two other hotels, the Southland and Hilton, are planning installations.

Newest of the commercial jobs in Dallas was the $15,000 job in the Liberty State Bank, installed by the Viking Air Conditioning Co.

Indicative of the interest and development in residential conditioning in Dallas was the report by Viking on recent installations. Among these were: a $2800 cooling and heating system for C. S. Hamilton, motor car executive: a $3000 heating plant for H. C. Otis, industrialist: and an elaborate central heating system for Morton Sanger, clothing store executive.

A $10,000 system to supply a 28-apartment dwelling in the exclusive Highland Park West Addition is also being installed by Viking Co.

Determines CO Accurately

WASHINGTON—Utilizing the principle that certain gases are partially opaque to specific wave lengths of radiation, Dr. E. D. McAlister, Smithsonian division of radiation and organisms, has perfected an instrument that will detect one part of carbon dioxide in a million parts of air in less than five seconds. A report on this investigation has just been published by the Smithsonian Institution.

Radiation of the specified wave band is passed through a sample of the atmosphere and allowed to fall upon a thermocouple where it sets up an electric current depending on the amount of radiation which has gotten through the atmospheric path. This current is recorded on a galvanometer, and provides a precise measure of the gas concentration.

By using other wave lengths the presence in like minute quantities of other gases, such as water vapor, can be determined. When both sensitivity and speed are considered, this new method is many times more sensitive than any other known to chemistry.

A.C. Public Relations Policy Outlined

BUFFALO—Featured on a program held here by the Air Conditioning Council of Western New York was an address by William B. Henderson, executive vice-president, Air Conditioning Manufacturers' Association. Mr. Henderson, presented a paper on "Air Conditioning's Responsibility to the Public" and after calling attention to the excellent showing which sales of air conditioning equipment are now making he also spoke regarding the necessity of keeping faith with the buyer.

According to Mr. Henderson, suppliers of air conditioning should follow basic rules of what constitutes good, ethical practice. He suggested that the three following rules should apply:

(1) That in the interests of the air conditioning industry we should not ourselves misrepresent, nor permit anyone else to misrepresent, what true air conditioning is and what a particular air conditioning installation will provide. The buyer should know exactly what he may expect for his money. One poor installation, one dissatisfied customer, is the worst possible advertising both for the seller and for the good name of the air conditioning industry, and can undo all the good will built up by fifty satisfactory installations and the beneficial word-of-mouth advertising by fifty satisfied customers.

(2) That in giving guarantees we should live up to our guarantees regardless of the consequences. The seller, who, just to secure a particular job, gives a buyer a promise impossible of fulfillment, hurts not only himself but everyone else in the business.

(3) Do not sell a cut-quality job. The buyer needs good air conditioning, whether he thinks so or not, and you need to put in a good installation in defense of your own good name and to promote your future sales. Also, you require a margin of profit on the work, so that you may continue in business. Any neglect of such fundamental rules hurts not only you and your customer but everyone else in the business and their customers in turn.

Mr. Henderson feels that the days of the high-pressure salesmen are about over in this industry and commended the council on its opportunity of being really helpful in keeping public confidence at a high level in Western New York.

Indo-China Railways Conditions New Cars

HANOI, FRENCH INDO-CHINA—Twenty-two de luxe cars of the French Indo-China Government Railways today are being fitted with air conditioning to provide year-round comfort on the 1050-mile route between Hanoi and Saigon, principal cities of the country.

A feature is a special heating unit using electricity for power. The heating is needed for a part of the run which goes through a mountainous section where temperatures drop to freezing.

The 22 cars consist of sleeping and dining cars. There are first, second, and third class sleepers and cars containing refreshment bars.

More A.C. Cars

NEW YORK—Two deluxe air conditioned coaches, the first of 50 which the New York Central Railroad is rebuilding, have been placed in service on the Empire State Express, the fastest train in New York State. The other cars will be used in trains between New York, Chicago, Cleveland, Detroit, and St. Louis.

For the Boston & Albany, 17 coaches are being air conditioned. Eight coaches for the Pittsburgh & Lake Erie are also being air conditioned.

Sheet Metal Men Start Courses

ST. LOUIS—An enthusiastic meeting of the Associated Sheet Metal, Air Conditioning & Heating Contractors of St. Louis, Inc., was held May 3 at the Claridge Hotel, with over 100 present. Addresses were made by E. Farris and G. B. Bendorf, representing the manufacturers and jobbers group, and announcing a series of 17 lessons on heating and salesmanship followed by a series on general sheet metal work, available to sheet metal and furnace installers. The meeting adjourned after 14 new members had been added to the association's membership.

Purdue Short Courses in Air Conditioning

LAFAYETTE, IND.—Two special intensive courses, one in mechanical refrigeration and the other in air conditioning, will be offered as features of the coming summer session of the University. The refrigeration course will last from June 18 to July 10 and the course in air conditioning from July 12-31.

These courses are designed for teachers, engineers, salesmen, students, and others interested in acquiring a working knowledge of the principles and general applications of refrigeration and air conditioning. They will be administered without the use of higher mathematics.

The courses will be given by Prof. H. G. Venemann in refrigeration and Prof. W. T. Miller in charge of air conditioning.

Opportunity will be given anyone to pursue special studies in addition to the regular work. University credit will be given to those who successfully pass examinations. Those who do not desire credit may omit the examinations. Further information may be obtained from the Mechanical Engineering School, Purdue University.

Texas Chapter Gets Charter

DALLAS—The Texas chapter of the ASHVE held a meeting April 15 at which President D. S. Boyden presented the chapter with its charter as an authorized local branch of the ASHVE. The charter was accepted on behalf of the chapter by its president, Prof. F. E. Giesecke. Twenty-six members and guests attended. President Boyden spoke on "The Economical Use of Purchased Steam" and was followed by Willis H. Carrier who was a guest at the meeting. Mr. Carrier spoke on the history of air conditioning.

After a discussion of the New London school disaster it was voted that Governor Allred be requested to appoint representatives of the chapter on a committee to compile a uniform building code for this state.

There was some discussion of the possibility of obtaining the next annual convention of the ASHVE for Texas, but no definite action was taken.

Boyden Speaks in California

LOS ANGELES—President D. S. Boyden was the guest of honor at the April meeting of the Southern California chapter of the ASHVE held April 20. In his talk President Boyden outlined the society's growth and reviewed its activities. He announced that a speakers' bureau service would soon be available to local chapters and that the national society will pay expenses for capable speakers for two or three meetings a year. The remainder of his address was on "The Economical Use of Purchased Steam."

The following officers have been nominated for the coming year: E. H. Kendall, president; H. M. Hendrickson, vice-president; J. F. Park, secretary; A. W. Cooper, treasurer; and Messrs. O. W. Ott, P. C. Scofield, W. D. Fabling, Leo Hungerford, board of governors.

A. C. Reduces Industrial Accidents

NORFOLK, VA.—A drop in accidents among workers in air conditioned factories was reported today by Dr. A. A. Berestneff, engineer of Carrier Corp., Newark, N. J., in an address before the Engineers Club of Hampton Roads, because of "higher efficiency of human beings occupied either in mental or physical work."

This meeting of the Engineers Club was a joint one with the Virginia sections and chapter of the American Society of Civil Engineers; American Institute of Electrical Engineers: Hampton Roads Chemists Club, ASME, and American Institute of Architects.

Outlining the health advantages of air conditioning through the benefit of clean, filtered, uniformly heated or cooled air, Doctor Berestneff said:

Regarding human beings, the combined influence of air temperature, humidity and motion is responsible for what we call a feeling of comfort which has its origin in a physiological state of body. This explains why the feeling of greater or lesser comfort is also accompanied by higher or lower efficiency of human beings occupied either by mental or physical work.

It also explains the fact that the number of accidents statistically observed in factories, mines, and other industries rises or drops with decrease or increase of the feeling of comfort, which results from greater or lesser physiological depression felt by the body, and gain or loss of the faculty of self preservation.

Start Research on Industrial Dust

PITTSBURGH—A plan of medical and engineering research to combat industrial diseases due to dusts and fumes, potential peril to the health of more than a million workmen, is announced by the Air Hygiene Foundation. The work is to be started as soon as arrangements can be made.

The organization, with headquarters at Mellon Institute, Pittsburgh, Pa., also announces the opening of a drive for broader support from industry to help this research. Approximately 170 firms, representing mining, metals, foundries, glass, refractories, ceramics and kindred industries are now affiliated with the Foundation, a non-profit, scientific organization.

The program calls for studies at Saranac Laboratory, Harvard School of Public Health, University of Pennsylvania Hospital, Singer Memorial Laboratory and Mellon Institute, and for work in cooperation with the U. S. Bureau of Mines. The research will seek to discover:

(1) Basic knowledge essential to determine the cause and prevention of diseases attributable to dusts and other industrial air pollutants.

(2) What the employer must do to safeguard the health of his workmen and to protect himself against false damage claims.

(3) Curtailment of the health hazards inherent in silica.

(4) More practical information in the field of chest X-rays.

(5) How to reduce the high pneumonia rate in smoky atmospheres.

A.C. Smith & Co. is 60 Years Old

NEWBURGH, N. Y.—A. C. Smith & Co., Inc., of this city late in April celebrated its 60th anniversary. The company is well known in this vicinity as installers and dealers in heating, oil burners, stokers, air conditioning, sheet metal work, sprinklers and plumbing. A full page of advertisements appeared in the April 20 issue of the *Newburgh News*, made up of congratulatory cards from a number of local business firms.

Soviet Has A.C. Conference

LENINGRAD—A conference on air conditioning was held recently at the Leningrad Institute of Labour Protection. The conference was attended by some 200 specialists from Moscow, Leningrad, Kharkov, Novosibirsk and other Soviet cities.

A paper on "Producing Artificial Climate" was read by Mr. Rosenbaum, head of the air conditioning laboratory of the Institute. He said that the first apparatus for producing artificial climate was put in operation at the Skorohod Shoe Factory in Leningrad on May 1. The apparatus is designed to regulate the temperature of a shop at the level of 20° C., to preserve the requisite humidity, and automatically to change the air every ten minutes.

Boston O. B. Group Discusses Free Service

BOSTON—At the monthly meeting of the Boston Oil Burner Associates G. Harvey Porter, managing director of Oil Burner Institute, was the principal speaker, and the meeting was devoted primarily to discussion of regional practices and problems requiring immediate consideration and action. Mr. Porter pointed out the general plan of endeavoring to secure the cooperation of distributors and dealers handling at least 85% of the burner and oil business in the territory, and the disregarding of annoying practices by others in the 15% group which is considered impractical to organize as a regular matter.

This was the fourth meeting held by the Boston group during the past month. At the dinner meeting the group endorsed the principle of eliminating free service and parts beyond the original guarantee period of one year, a matter which had previously been recommended by the American Petroleum Institute—Oil Burner Institute cooperative committees. Exceptions to this practise were discussed and a planned cooperative approach to the problem was decided upon.

After a general discussion of policies in the handling of builders' business, the president appointed a committee from the membership to consider this matter and bring in a recommendation at another meeting which was scheduled for the near future.

The various elements of sales and installation costs were discussed and an approximation made of the average experience of those present under each classification. From this it was evident that intelligent care must be exercised by those sound units in the industry to assure coverage of necessary cost elements in the determination of prices.

Toronto Chapter Awards Prizes

TORONTO—Forty-six members attended the annual meeting of the ASHVE Ontario chapter held at the Royal York Hotel May 3. Following the dinner President T. McDonald called upon Mr. Blackhall to make the report of the Ontario chapter award. This year's prize of $25 will be given to C. E. Beynon who wrote on "The Properties and Economic Possibilities of Heat Insulation for Buildings." Second and third prizes, consisting of a copy of the *Guide*, were awarded to Messrs. DeMaio and Trusler.

The weather committee of the local chapter has collected data from the principal cities in Canada and will soon forward design data on dry and wet bulb temperatures to the *Guide* publication committee. This committee is also collecting data on summer city water temperatures for use in the *Guide*.

Officers nominated by the Ontario chapter for the coming year are: G. A. Playfair, president; H. Jenney, vice-president; H. R. Roth, secretary; H. D. Henion, J. O'Neill, O. L. Maddux, T. McDonald, board of governors.

N. Y. Burner Dealers Discuss Trade Conditions

NEW YORK—Twenty-five key dealers in oil burners and fuel oil supplying the metropolitan market met May 12 to discuss and determine a course of action on the adverse problems confronting the industry in New York City. The meeting was sponsored by Oil Burner Institute and Metropolitan Oil Burner and Air Conditioning Association. After dinner had been served, Earl Marr, chairman, opened the meeting which was addressed by A. J. McAllister, president of the association.

G. Harvey Porter, managing director of the Oil Burner Institute, described in detail the task that the institute was endeavoring to accomplish on behalf of the industry in the principal markets of the country. Mr. Porter emphasized that problems affecting the welfare of the industry in the five boroughs were capable of practical solution when approached with all the facts in hand and subjected to dispassionate analysis. He told his audience that Oil Burner Institute was ready and willing to assist in this work.

Subsequent statements in discussions alleged that existing problems include unfair local advertising by a competitive industry. The subject of builder's prices and its accompanying abuses were gone into as well as free burner service and it was decided to hold subsequent meetings in order that these practices be thoroughly studied before deciding on a course of remedial action.

The meeting went on record as being definitely opposed to the licensing of oil burner dealers which was described as class legislation and discriminatory.

Coal Heat Show Proves Successful

CHICAGO—That homeowners and people in general are very much interested in automatic coal heat is evidenced by the crowds visiting the stoker and coal exhibits at the Chicago National Home Show which ended its 10-day run at the Chicago Coliseum. May 16. Over 2000 sq. ft. of floor space were contracted for by the cooperating stoker and coal exhibitors.

Previous to the opening of the Show on May 8 the Midwest Stoker Association and the Chicago Coal Merchants Association, which joined in conducting the exhibits on an industry basis, distributed nearly 700,000 complimentary admission tickets on which was printed a special message about automatic coal heat and a basement modernization contest being sponsored by the Chicago Coal Merchants Association. The success of the Show in a large part is attributed to the vast distribution given the tickets by these two groups. Every coal merchant in the Chicago area, cooperating with stoker agencies and dealers, distributed these tickets to homeowners in various manners. The result was that combined with the home show's own promotional campaign the crowds and attendance at the Show so far have surpassed the attendance at home shows held in Chicago for a good many years.

St. Louis Chapter Meets

ST. LOUIS—A new chapter of the ASHVE has been granted a charter in Atlanta, Ga., according to the secretary of the local chapter in his report at the April 19 meeting.

Speakers at the meeting included R. J. Tenkonohy, secretary of the St. Louis chapter, who spoke briefly about the recent annual meeting, and J. V. Clippenger, senior student in heating and ventilating at the Carnegie Institute of Technology. Mr. Clippenger abstracted a report on the operating experiences of the air conditioning system in the Philadelphia Savings Fund Society Building.

The principal speaker of the evening was E. H. Gurney of Toronto, first vice-president of the ASHVE. Mr. Gurney described his experiences during his recent trip to South Africa.

Alabama A.C. Up

BIRMINGHAM, ALA.—A three-year missionary program in behalf of air conditioning is now bearing fruit for the Alabama Power Co. with the result that more connected load was added to the company's lines during the first four months of the year than existed prior to 1937 according to a report by Chester Gause, air conditioning engineer.

For this four-month period there were 28 installations with 1790-hp. load. This compared with 78 installations with 1601 hp. in use at the end of 1936. When the company began its promotional program in 1933 there were only five installations on its lines, employing 762 hp. All figures are for territory served directly by the Alabama Power Co. and do not include Birmingham.

Mr. Gause said that efforts of the company have been to stress the different applications of air conditioning with emphasis placed on number of installations rather than load values alone.

Largest installation on the company's lines is that for the lobby and office building of the First National Bank of Mobile, a 575-hp. job. L. O. D'Olive, the company's power representative in Mobile, is credited with 12 installations and 955 hp. for the first four months of the year. He handled the bank job as well as the air conditioning of every theater and practically every restaurant in downtown Mobile.

Utility Promotes A. C.

BIRMINGHAM, ALA.—A booklet listing 70 air conditioning installations in Birmingham, with testimonials as to its business-getting value from a number of concerns, has just been published by the Birmingham Electric Co. The value of air conditioning in a district where there is considerable smoke and fog is especially stressed.

Eleven air conditioning dealers are listed in the booklet, including two new ones just appointed; namely, the Pate Co. for General Electric equipment, and Bethune Electric Co. for Westinghouse products. The electric utility does not sell air conditioning but does supply both power and heat for year-round plants.

Honors Angus

TORONTO, ONT.—The ASHVE Ontario Chapter met with four other engineering societies recently at a luncheon in the Royal York Hotel to honor Prof. R. W. Angus, head of the department of mechanical engineering in the University of Toronto, who has completed fifty years of engineering. Professor Angus is an authority on engineering problems associated with heating systems.

The necessity of having definite codes, governing the heating, air conditioning and refrigeration trades has been stressed by the Ontario Chapter. Speakers well versed in the industry have stressed this need from time to time, but the board of governors has just taken up the matter in earnest by appointing a committee to study regulations for the industry.

Dr. Hill Joins Institute

CHICAGO—Dr. E. Vernon Hill, authority on air conditioning, has been appointed to the newly created post of director of research and education for the Refrigeration and Air Conditioning Institute, this city, according to Ray D. Smith, president.

Doctor Hill, who assumed his duties April 1, will outline, coordinate, and supervise the preparation of all lesson assignments used in the home study section of the Institute's training, and work out a proper routine to be followed by students when they come to Chicago for their final two or four weeks of shop training.

Harlan Heads ACMA

HOT SPRINGS, VA.—The average American's steadily increasing demand for comfort and health in his daily life is "the foundation of the country's fastest growing industry," according to J. A. Harlan of Detroit, Nash-Kelvinator Corp. executive and newly-elected president of the Air Conditioning Manufacturers Association.

Mr. Harlan was made head of the association at the annual meeting. Also elected were William H. Price, Jr., Carrier Corp., Newark, N. J., vice-president, and P. A. McKittrick, Parks-Cramer Co., Fitchburg, Mass., treasurer. The directors are the officers and W. F. Armstrong, Delco-Frigidaire Co., Dayton, Ohio; P. Y. Danley, Westinghouse Electric and Manufacturing Co., Mansfield, Ohio; J. J. Donovan, General Electric Co., Bloomfield, N. J.; Stewart E. Lauer, York Ice Machinery Corp., York, Pa., and J. F. G. Miller, B. F. Sturtevant Co., Boston.

A sharp upturn in inquiries on air conditioning received at the association's headquarters in Washington was reported by William B. Henderson, executive vice-president, who also announced progress in research work on the health aspects of air conditioning and in the industry's approval of a concerted program of seasonal themes for adoption in individual members' advertising work.

Air Pollution Revealed in Pittsburgh

PITTSBURGH—Atmospheric pollution was the subject which occupied the attention of those attending the May 10 meeting of the local chapter of the ASHVE, M. I. Dorfan, dust collector division, Blaw Knox Co., discussed the scope of this subject and then presented Director H. B. Mellor of the Air Hygiene Foundation who spoke on the Sources of Atmospheric Pollution. Director Mellor was followed by Dr. Frank Holden, hygienist for the Pittsburgh Plate Glass Co., who described the various instruments used in dust determinations.

Following these speakers H. R. Loxterman, engineer for Blaw Knox Co., presented slides devoted to the various methods of dust collection, including the settling chamber, cyclone separators, viscous filter, dry cloth filter, and electrical precipitator.

Chicago Group Hears Talk on Car Heating

CHICAGO—Seventy-eight were present at the April 12 meeting of the ASHVE Illinois Chapter held at the Hotel Sherman, at which the Clarkson coil steam generating unit was the subject of a brief talk by E. A. Russell, chief engineer of the Vapor Car Heating Co. Mr. Russell explained that with the new diesel-powered railway trains it is necessary to have a steam boiler for heating. The necessity for a low water boiler led to the development of the coil type steam generating unit.

Mr. Russell then turned the discussion over to Alick Clarkson, consulting engineer of the Vapor Car Heating Co., who presented a detailed discussion of the unit.

Thomas H. Conway, Sr.

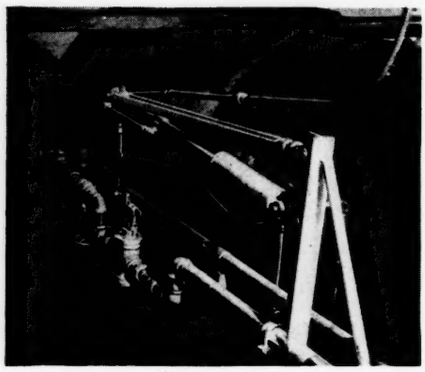
DETROIT—Thomas H. Conway, Sr., president of the Great Lakes Manufacturing Co., died March 31 at the age of 72.

Born in Toledo, Mr. Conway founded the Lincoln Stove & Range Co. and Fremont Stove & Range Co., of Fremont, Ohio, and the Regent Stove & Manufacturing Co., of Detroit and Wyandotte.

Mr. Conway retired from active business five years ago.

Surviving are his wife, four daughters, two sons, and 26 grandchildren.

NEW EQUIPMENT



Campbell Boiler Feed Water Level Control

NAME—Campbell-Cantilever boiler feed water level controller.

PURPOSE—To maintain boiler water levels to within ½ in.

FEATURES—The control is mounted on the side of the boiler so that it is easily accessible. Frame is set so that the water level mark is at the same level as the desired water level in a column. When the water level drops in the gage glass, water runs down an inclined tube exposing it to the high temperature of the steam at boiler pressure. This causes rapid expansion which is multiplied eight times due to triangular construction. This causes the end casting to move upward, which opens the valve an amount equal to eight times the extent of the expansion. If the water rises in the gage, the cooling action of the cool water rising in the tube causes contraction which lowers the end casting and closes the valve by an amount equal to eight times the contraction. This multiplied principle of contraction and expansion assures sensitive regulation heretofore not available, according to the manufacturer. The action is automatic and requires no manual operation or attention from the boilerman. As an extra safety measure, there can be attached either a whistle or an electric signaling device. The photograph shows the controller mounted on a firebox boiler.

SIZES—Made in one size to meet all boiler needs and to operate any valve up to 12 in.

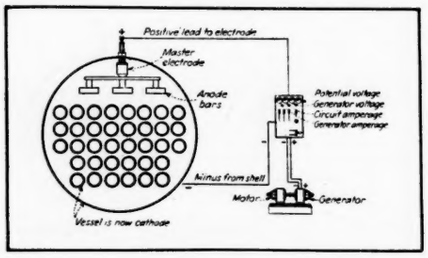
MADE BY—*J. A. Campbell Co., Box 851, Long Beach, Calif.*

Kirkaldy Boiler Protection System

NAME—Kirkaldy system of metal protection.

PURPOSE—An electrolytic system for preventing corrosion and boiler scale.

FEATURES—The Kirkaldy system is said to take into consideration the causes for corrosion rather than its effects. It is claimed that it controls corrosion by confining it to bars and metal placed into the boiler water for that purpose. The installation consists of a number of suitable anodic bars or disks made of mild steel or carbon mounted within and electrically insulated from the boiler or condenser, an electric motor generator and automatic current controller, a control switchboard and the necessary wiring to complete the circuit.

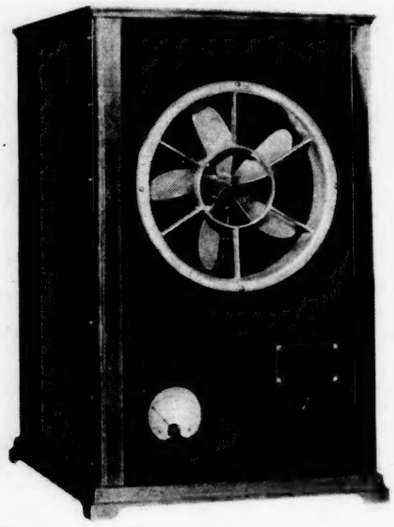


METHOD OF OPERATION—With the system in operation the boilers, condensers, pumps, heaters, and pipe lines have a negative polarity instead of the usual positive polarity. The positive poles of the system are the anodic bars. This reverse polarity is said to prevent corrosion of the equipment. It is maintained by a weak direct current supplied by the motor generator and controlled at the small switchboard. It is also said that scale and slime cannot adhere to the walls of the equipment since the acid radicals, such as carbonate, sulphate and silica, which are necessary in building up the scale are electrically carried away to the anodes and away from the equipment surfaces. If the scale is already present when the installation is made, it is said that a thin film of liberated hydrogen which is formed on the metal walls of the equipment will gradually loosen the scale and remove it altogether. The voltage required is from 5 to 10 volts depending on the conditions and the current consumption is said to be approximately 0.4 kw-hr. per day per 1000 sq. ft. of protected surface with salt water and 2.0 kw-hr. per day per 1000 sq. ft. with fresh water.

MADE BY—*Electrolytic Metal Protection, Inc., 247 Park Ave., New York.*

Electroaire Ozonator

NAME AND MODEL NUMBER—Electroaire ozone generator, model FO.

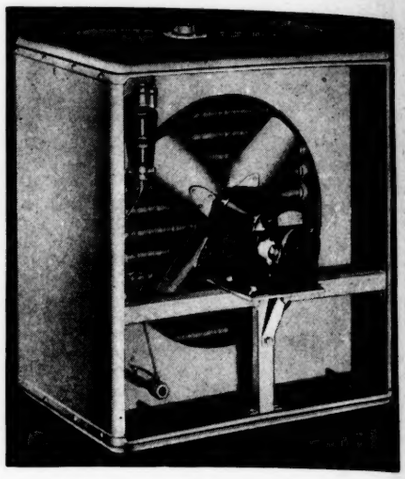


PURPOSE—For generating ozone to destroy odors in rooms.

FEATURES—The manufacturer states that a marked improvement is the "Roto-Beem" circulator which is used in place of the ordinary fan. This patented air circulator is said to build up a spiraling air stream which sucks the air from all sides and from ceiling to floor, giving a faster and wider volume of air distribution and consequently a faster and greater distribution of ozone. The air stream is also given a pulsating action which is said to produce a pleasant effect on the occupant.

SIZES AND CAPACITIES—Two sizes, one capable of ozonating 8000 cu. ft. and the other 20,000 cu. ft.

MADE BY—*Electroaire Corp., 1455 W. Congress St., Chicago.*



Fedders Unit Coolers

NAME AND MODEL NUMBER—Fedders unit coolers Series 73.

PURPOSE—For supplying cooled air for comfort cooling and commercial refrigeration.

FEATURES—Cooling element is made of seamless copper tubing with flat copper fins. The fins are arranged vertically to provide quick drainage of condensate. Inlet and outlet of all banks are manifolded in parallel by means of headers brazed to tubing. Cooling element is furnished with a silver satin finish. Fedders thermostatic expansion valves are standard equipment. Cabinet is made of permanent rust-proof metal with the bottom insulated to eliminate accumulation of condensate on the outside of the cabinet. A ½ in. pipe tap drain connection is provided for draining off the condensate. Adjustable louvres can be furnished as extra equipment when specified.

SIZE AND CAPACITIES—Available in 15 sizes with capacities ranging from 3330 to 9400 B.t.u. per hr. based on air inlet temperature, 38F, refrigerant inlet temperature, 14F and refrigerant outlet temperature, 34F. Capacities range from 11,250 to 32,900 B.t.u. under comfort cooling conditions 80° dry bulb, 67° wet bulb and 40° refrigerant.

MADE BY—*Fedders Mfg. Co., Buffalo, N.Y.*

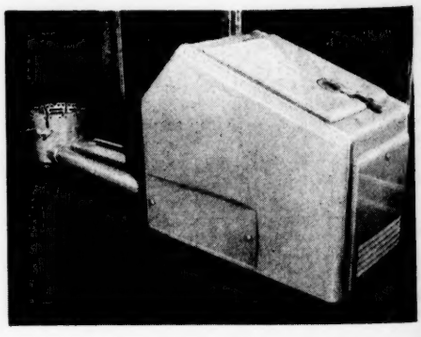
Iron Fireman Domestic Stoker

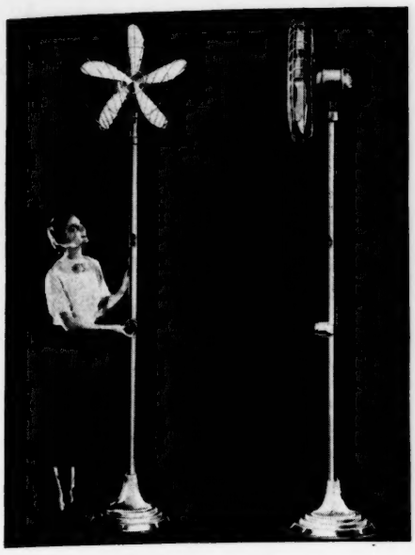
NAME—DeLuxe and Junior model Iron Fireman domestic coal stokers.

PURPOSE—Complete home heating.

FEATURES—Improved modern styling; operating unit enclosed in sound-silenced compartment beneath the hopper; full automatic thermostatic control; planetary gears adopted for compactness; new Volumeter for automatically attaining proper air supply for maximum combustion efficiency.

MADE BY—*Iron Fireman Mfg. Co., Cleveland, Ohio.*





Roto-Beam Air Circulator

NAME—Roto-Beam air circulator.

PURPOSE—A special type fan for air circulation.

FEATURES — Manufacturer states that the Roto-Beam produces an actual moving beam of air, whirling helically, and causing a suction which draws the air from the lower, upper, and all intervening sections of the fan blade. This beam of air is said to cause circulation of all the air in the room. It is said that the Roto-Beam blade floats because the helical moving stream of air which is discharged in front of the blade at a high rate of speed forms a gyroscopic action which eliminates the up and down thrust of the blades. The helical moving air stream discharged from in front of the blades is said to draw the air in from the back by a vacuum and it is said that this vacuum action reduces back thrust to a minimum, thereby according a long life to bearings and motors.

SIZES—Available in a.c. and d.c. three speed models in 18, 20, and 24 in.; junior models 8, 10, and 12 in. a.c. and d.c. in three speeds and 12 in. De Luxe model.

MADE BY—*Roto-Beam Corp.*, 3300 *Indiana Ave., Chicago.*

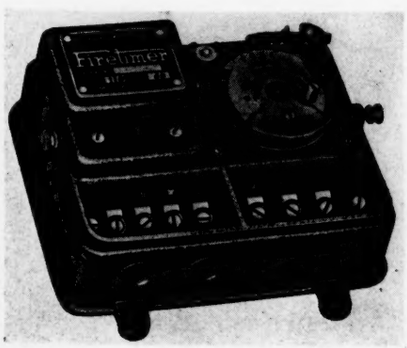
Fairbanks-Morse Fire-Timer

NAME—Fairbanks-Morse Fire-Timer.

PURPOSE—For automatic coal burner operation.

FEATURES—This new device is said to prevent losing fire during even the mildest spring or fall weather by automatically operating the stoker for brief periods at predetermined intervals. Timer can be set to operate either at hour and half-hour intervals or any desired period of time. Although independent of thermostatic control, the Fire-Timer is said to be coordinated with it to avoid excessive burning. Should the timer normally start the burner just following a period of operation by the thermostat, this period is missed and the burner is not started until the predetermined interval later. The device is completely enclosed in an attractive black metal case. Available only with the Fairbanks-Morse stoker.

MADE BY—*Fairbanks, Morse & Co.*, 900 *S. Wabash, Chicago.*



Ferro-Nil Water Conditioner

NAME—Ferro-Nil water conditioner.

PURPOSE—To prevent corrosion and failure of water circulating equipment by correcting acid condition of the circulated water used in air washers, cooling towers, condensers, and similar equipment.

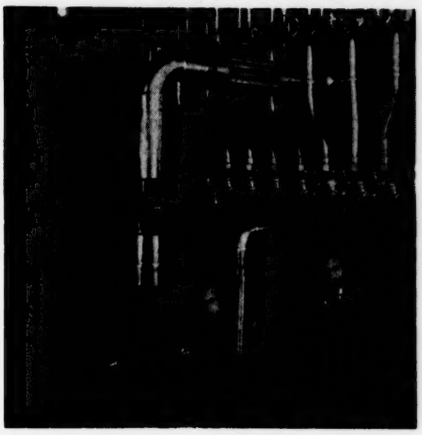
FEATURES—A compact, simply operated feeder is installed on the water circulating pump and a special chemical solution is charged into the feeder daily. This solution is said to provide constant and uniform neutralization of the acidity resulting from acids picked up by the water from the washed air.

MADE BY—*Ferro-Nil Corp., 500 Fifth Ave., New York.*

American Vibration Eliminators

NAME—American vibration eliminators.

PURPOSE—To prevent the transmission of the noise and vibration from compressors or pumps through pipe lines to the building structure.



FEATURES—Vibration eliminators consist of a short section of flexible seamless bronze tubing with standard copper tube "slip fittings" welded on to both ends. The welding is said to be done at a temperature of over 1500F so that there is no possibility of weakness developing when the eliminator is soldered into the refrigerant line. The copper tube ends are designed to slip over standard makes of copper water tube or into standard solder fittings with just enough clearance to allow for a tight soldered joint.

SIZES—Available in either male or female connections, the sizes ranging from 3/16 to 3 in. and lengths from 5¼ to 60 in.

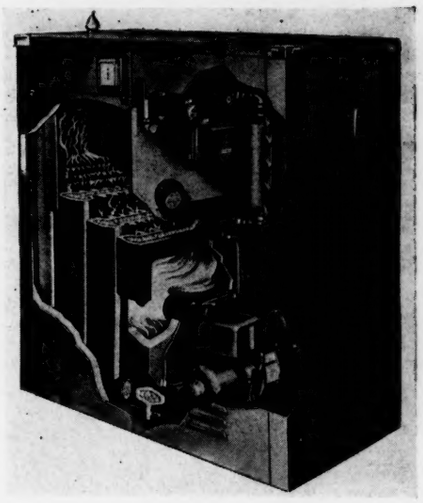
MADE BY—*American Brass Co., Waterbury, Conn.*

Hart & Crouse Oil Burning Boiler

NAME AND MODEL NUMBER—Royal oil boiler, No. 19.

PURPOSE—For supplying steam or hot water utilizing oil as a fuel.

FEATURES—Boiler is completely automatic and all parts are enclosed in an attractive green jacket. Boiler sections have joints packed with ½-in. hard asbestos rope to seal the joints and prevent the escape of odors and infiltration of air. It is said that the packing also affords a cushion to protect the sections from expansion strains. Many small projecting surfaces are used to split the hot flue gases into small streams in order to extract the maximum amount of heat. Boiler sections are so constructed that water entirely surrounds the combustion chamber. A refractory hearth made in two halves is provided and no special setting is required. Cleanout plates are provided for cleaning the flue areas. One and a half inch asbestocel insulation is installed on the front, back, top, and sides to retard heat loss and prevent the transmission of noises. A combination low water and pressure switch is used to protect the water line of the boiler and check oil burner operations against excessive pressure. A domestic hot water heater is also provided.



SIZES AND CAPACITIES—Available in five sizes for steam radiator surface from 350 to 915 sq. ft.

MADE BY—*Hart & Crouse Co., Inc., 301 Turner St., Utica, N. Y.*

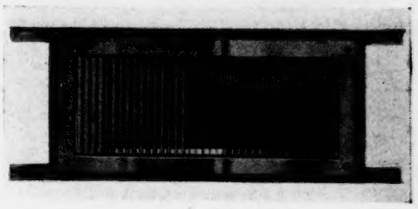
Hart & Cooley Adjustable Grille

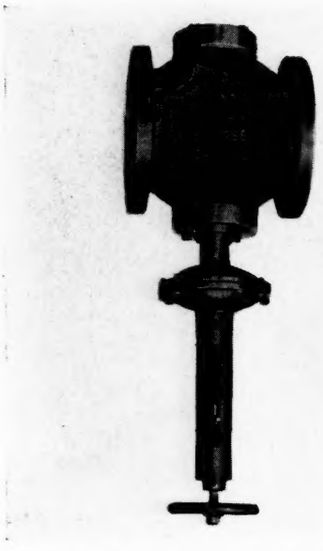
NAME AND MODEL NUMBER—Adjustable deflection grille No. 84.

PURPOSE—For use with warm air heating or air conditioning systems to provide any desired distribution of air within the room.

FEATURES—The bars of the grille may be rotated through an arc of 90°; that is, 45° either way from straight. The bars of each 2-in. section are connected with each other so that if any bar in a section is turned all the bars in the entire section turn simultaneously. The link connecting the bars in each section is provided with a friction device which securely holds the bars in the position in which they are set but permits the bars to be readily turned for any desired deflection by means of a key. If desired, the bars may be permanently clamped in place by means of locking screws. Practically any directional flow setting may be obtained. It is said that the close spacing and the depth of the bars provides exceptional concealment of the duct without sacrificing free area.

MADE BY—*Hart & Cooley Mfg. Co., Holland, Mich.*





Illinois Reducing Valve

NAME AND MODEL NUMBER — Illinois reducing valve, Type M.

PURPOSE — To control the flow of steam through a full range of pressures from 10 lb. to as low as 28 in. of vacuum for low pressure heating and process work.

FEATURES—A spring attached to one side of the diaphragm on the low pressure side of the valve can be placed under tension or compression. An indicator shows the spring condition. Turning the handwheel at the bottom of the assembly adjusts the valve to control pressures above, at or below atmosphere. There are no stuffing boxes or sealing devices used and it is said that the valve instantly responds to slight variation in load. Diaphragm is said to maintain set pressure or vacuum on the delivery side of the valve under fluctuating inlet pressures. Diaphragm is made of composition or metal depending upon the conditions of use. Valve is made with iron body and a bronze trim.

SIZES—Up to 10 in.

MADE BY—*Illinois Engineering Co., Chicago, Ill.*

Willson Welding Helmet

NAME—Willson welding helmet.

PURPOSE—For protection of welding operators.

FEATURES—Helmet is formed of one-piece black vulcanized fibre and cut deeply to offer side protection to a point well back of the ears. It has a smooth, rounded interior which is said to promote air circulation and to result in a well ventilated and cool helmet. A 2 x 4¼ Willson-Weld glass is standard in the new helmets. The company is also making several different styles of helmets in one-piece construction as well as a new line of one-piece hand shields.

MADE BY—*Willson Products, Inc., Reading, Pa.*

E. F-M. Boiler Cleaner

NAME—Boiler cleaner.

PURPOSE—For removing rust, oil, scale, and dead organic matter from heating systems.

FEATURES—Manufacturer states that the boiler cleaner will combine with the oil from core sand, pipe-cutting compounds and like materials to form a water soluble emulsion that drains out cleanly. The proper amount of boiler cleaner is added to the boiler water and allowed to remain there for several days while the boiler is being operated in the normal manner. The water is then drained off while it is hot. An additional charge of boiler cleaner is then added to the boiler and allowed to remain there for the entire heating season. This is said to act as a water conditioner to reduce the formation of the scale and minimize corrosion.

MADE BY—*Electric Furnace-Man, Inc., 7 Dey St., New York.*

Burt Gravity Ventilator

NAME—Burt standard gravity ventilator.

PURPOSE—A roof ventilator for ordinary ventilation work.

FEATURES—To insure an unrestricted passage to the ventilator head the area of the protected free outlet is in excess of the airshaft area. An exclusive Burt inverted louver is said to efficiently direct any upward flowing air currents through the ventilator head, thereby increasing its siphonage action and preventing backdrafts. A large suction area is provided by an amply proportioned windband. Screening is provided in two ways, one by a framed circular screen fastened to the ventilator airshaft and removable from below, the other by a permanent screen positioned vertically in the protected outlet area of the unit. Standard construction material is open hearth galvanized steel. Optional materials include copper bearing steels, Armco or Toncan iron, Corten steel, aluminum, copper, commercial lead coated copper and Feltcote asbestos protected steel.

SIZES AND CAPACITIES—19 sizes ranging from 6 to 96 in. vent size.

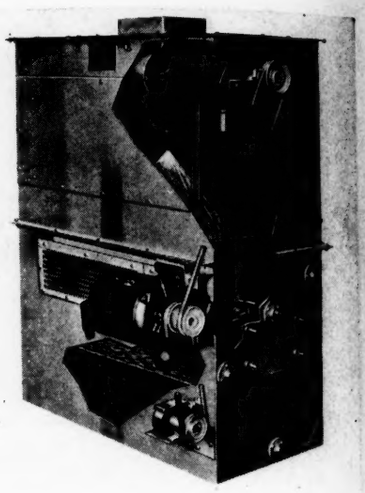
MADE BY—*The Burt Mfg. Co., Akron, Ohio.*

Strang Evaporative Condenser

NAME AND MODEL NUMBER—Strang evaporative condenser, series R.

PURPOSE—For cooling condenser water for refrigerating machines.

FEATURES—Condenser is made in sections which are easily detachable to facilitate installation and handling without disturbing internal piping. The lower section is of heavy plate, electrically welded and protected internally by asphalt finish. The top sections are heavy gage black iron protected by aluminum finish and asphalt. The coils in the standard units are made of copper while in the ammonia units they are made of aluminum or steel. A separate motor is provided for the water pump and fan drive and the water pump is directly connected through a flexible coupling to its drive motor. The fan motor is connected through a V-belt drive to its motor. The liquid receiver can be mounted submerged in the water tank or external as desired. Filters for the air intake are available on all models. All models may be had weatherproofed for outdoor installation. When designed for outdoor use they include splash-proof motors, enclosure for V-belt drives and weatherproof enamel.



SIZES AND CAPACITIES—Available in 10 sizes ranging from 5 to 45 tons m.i.e. 24 hr.

LITERATURE AVAILABLE—Technical data bulletin series R.

MADE BY—*The Motor Equipment Co., Wichita, Kansas.*

Friez Relay Transformer Set

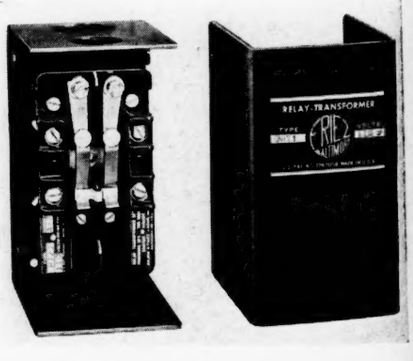
NAME—Friez relay transformer set.

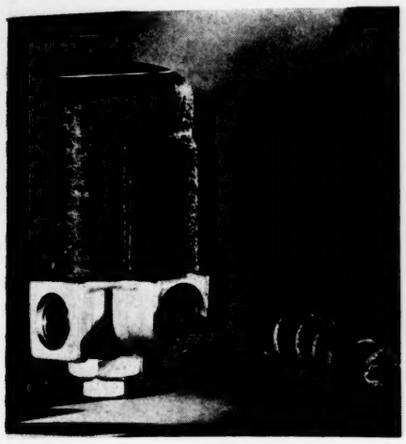
PURPOSE—For use with and to provide low voltage current for sensitive control instruments such as thermostats, humidistats, and effective temperature controls to control the operation of equipment drawing heavy electric loads such as electric motors, fans, pumps, oil burners, and like equipment.

FEATURES — The new relay transformers operate on the "magnetic leakage" principle and provide their own supply of low voltage current for the control circuit and for the operation of their own magnetic coils. The transformers are built right into the relays themselves. The same magnetic coils which operate the relay produce low voltage required (20 volts). The whole assembly is one unit and everything is interwired and ready to connect to the supply, load and control instrument. The manufacturer states that no relay hum is present. Loads up to ¾ hp. or 1000 watts can be handled. All types of circuits from either 110 or 220 volts a.c. supply can be handled.

LITERATURE AVAILABLE—Bulletin AT/R.

MADE BY—*Julien P. Friez & Sons, Inc., Baltimore, Md.*





Automatic Products Solenoid Valve

NAME AND MODEL NUMBER—Solenoid valve, model 73-RB.

PURPOSE—For liquid and suction line control of Freon, methyl chloride and sulphur dioxide in refrigeration and air conditioning applications.

FEATURES—The manufacturer states that one of the outstanding features of construction is the removable seat assembly. By removing the bottom plug the seat can be unscrewed and both seat and needle assembly fall out for inspection and cleaning. It is said that it is never necessary to remove the valve from the line. Other features include a brass forged body, a non-magnetic steel alloy seat and stainless steel valve stem, completely sealed coil, impact type plunger and 38-in. lead-in wires.

SIZES—The valve is tapped to ⅜-in. pipe fitting.

LITERATURE AVAILABLE—Bulletin No. 401.

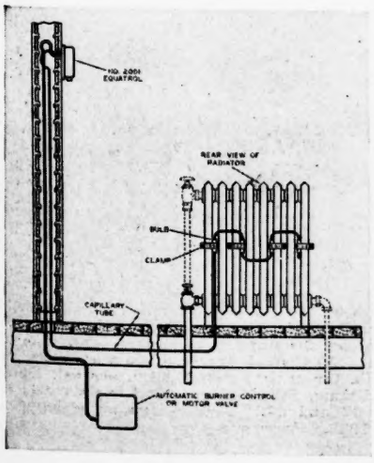
MADE BY—Automatic Products Co., Milwaukee, Wis.

Arco Thermostat

NAME—Arco Equatrol.

PURPOSE—A thermostat designed to eliminate stratification and uncomfortable lags in heat pick-up and at the same time to insure a constant supply of radiant heat. For use with steam, vapor, or vacuum heating systems and any type of automatic heating.

FEATURES—Thermostat is said to respond directly to radiator temperature as well as the temperature of the room. Four small bulbs, attached to four different sections of a radiator or convector to get the average radiator temperature, operate to keep the radiator always warm. Thus a constant air motion through convection currents as well as a constant supply of radiant heat is maintained. Room thermostat operates in the usual way while the radiator attachment, by keeping the radiator warm, is said to eliminate lag by calling for heat before the room temperature has dropped below the comfort point. The room thermostat bulb is built to operate on room temperature changes of 1/5F or plus or minus 1/10F while the radiator bulbs are operated on radiator temperature changes of 10F or plus or minus 5F. The new unit is wired and installed in the same manner as the low voltage room thermostat and is regularly furnished with 20 ft. of capillary tubing.



MADE BY—*American Radiator Co., 40 W. 40th St., New York.*

Worthington Boiler Feed Pumps

NAME — Improved high pressure multistage centrifugal boiler feed pumps.

PURPOSE—A boiler feed pump for pressures up to 1200 lb. per sq. in.

FEATURES—An even number of impellers facing in opposite directions serve to equalize the action of forces and eliminate balancing drums or disks. In addition, large thrust bearings are provided to insure long life and reduce maintenance costs. A staggered volute construction effects radial hydraulic balance so as to reduce wear or internal clearance and to eliminate stuffing box troubles. Other improvements are an internal interstage loop casing, shaped to prevent erosion and eddy currents and heavy oil-lubricated ball bearings mounted in dirtproof housings. Horizontally-split casing permits the pump to be taken apart for inspection or repair.

SIZES AND CAPACITIES—Made in three sizes from 4 to 8 in., for capacities ranging from 200 to 1500 g.p.m., for pressures up to 1200 lb.

LITERATURE AVAILABLE—Bulletin W-318-B7A.

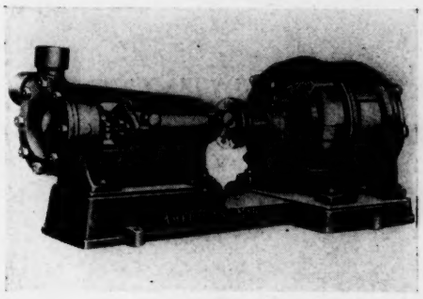
MADE BY—*Worthington Pump and Machinery Corp., Harrison, N. J.*

American-Marsh Turbine Pump

NAME—Type V turbine pump.

PURPOSE—A direct motor-driven pump for handling any non-viscous liquid which is free of abrasive matter.

FEATURES—There is only one moving part, a balanced impeller. The manufacturer states that unlike centrifugal pumps the Marsh turbine pump gives much higher heads for any given impeller diameter and speed and that the power required increases as the head decreases. It is said that the mechanical efficiencies are unusually high and that with small capacity pumping against high heads the pumps will give marked economy in power cost over centrifugal pumps. It is also said that when the turbine pump is directly connected to an electric motor or other prime mover of sufficient power to handle the maximum pressure, it cannot overload the driver should the pressure be less than estimated. It is stated that the turbine pump operates successfully on suction lifts up to 28 ft. Pumps are designed for speeds up to 3500 r.p.m. and are built in single stage construction for pressures up to 175 lb. For higher pressures they are built in series or two-stage construction. Each pump comprises two main assemblies, one consists of the casing and all other parts which come in contact with the liquid handled and the other made up of the parts required for the mechanical operation of the entire unit. Interchangeability of several sizes of casings on each inboard head is provided for in the design. This is said to make possible quick and inexpensive replacement of any parts, minimum cost for special metal pumps and stand-by protection for merely the cost of three simple parts. The casing is of high-tensile cast iron while the impeller is of cast bronze with radial vanes cut to accurate dimensions on both sides of the periphery. Shaft is of stainless steel while the glands are of cast bronze.



LITERATURE AVAILABLE—Bulletin 450.

MADE BY — *American Steam Pump Co., Battle Creek, Mich.*

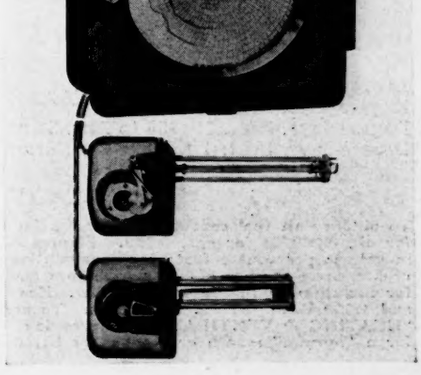
Friez Humidity and Temperature Recorders

NAME—Round chart recording instruments for relative humidity and temperature.

PURPOSE—For indicating relative humidity or temperatures.

FEATURES—Instruments are available in two types, one the self-contained type for recording conditions immediately surrounding the instrument and the other, remote or distance transmission type for indicating and recording conditions at a remote point. The self-contained types have the sensitive element and all mechanism contained within the recorder case, the whole being arranged for wall or panel mounting. The remote type instruments are available with either of two types of transmission, one with a capillary tube for short distances and the other with a synchronous electric transmission for distances over 25 ft. In the long distance transmission type the only connection required between the sensitive elements and the indicator is a low voltage 5 or 3 conductor wire. The manufacturer states that this is the first time that the transmission of relative humidity direct from remote distances has been available. Recorders for either daily or weekly operation are available. The standard instrument has an electric clock movement; spring wound clocks are available on special order. All recorders will handle humidity range from 0 to 100%. Various temperature ranges may also be covered. The standard is from 0 to 100F.

MADE BY—*Julien P. Friez & Sons, Inc., Baltimore, Md.*



Degree-Day Figures for April, 1937

HEATING & VENTILATING continues its ninth year of publishing degree-day data for various large cities.

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for April, 1937	560	191	354	136	595	658	704
Degree-days, Sept. 1, 1936 to Apr. 30, '37	5037	2698	4092	2351	5455	6253	7217
Degree-days, Sept. 1, 1935 to Apr. 30, '36	6371	3278	4683	2925	5918	6913	7644
Degree-days, Sept. 1 to Apr. 30, Normal	6396	2890	4511	2352	5800	6474	7344

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for April, 1937	718	554	368	535	420	534	480
Degree-days, Sept. 1, 1936 to Apr. 30, '37	7291	6019	4826	5521	5091	5927	6601
Degree-days, Sept. 1, 1935 to Apr. 30, '36	7092	6738	5524	6228	5881	5562	7219
Degree-days, Sept. 1 to Apr. 30, Normal	6893	6042	4684	5935	5236	5607	6266

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for April, 1937	607	332	842	80	591	286	510
Degree-days, Sept. 1, 1936 to Apr. 30, '37	6225	4082	9312	2747	5757	4312	5907
Degree-days, Sept. 1, 1935 to Apr. 30, '36	6847	5207	9928	2335	6468	4910	6670
Degree-days, Sept. 1 to Apr. 30, Normal	6264	4988	8721	2428	6009	4264	5804

	Grand Rapids, Mich.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Kansas City, Mo.	La Crosse, Wis.	Lincoln, Neb.
Degree-days for April, 1937	578	458	538	432	348	564	428
Degree-days, Sept. 1, 1936 to Apr. 30, '37	6272	5066	5503	5289	5194	7538	6246
Degree-days, Sept. 1, 1935 to Apr. 30, '36	6878	5558	5865	6023	5596	8057	6743
Degree-days, Sept. 1 to Apr. 30, Normal	6361	5285	5834	5239	4840	7139	5952

	Little Rock, Ark.	Los Angeles, Calif.	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.
Degree-days for April, 1937	173	108	301	648	153	668	615
Degree-days, Sept. 1, 1936 to Apr. 30, '37	3186	1390	4353	7319	3181	6659	8118
Degree-days, Sept. 1, 1935 to Apr. 30, '36	3509	1112	4955	7885	3647	7289	8850
Degree-days, Sept. 1 to Apr. 30, Normal	2811	1414	4180	7160	2950	6856	7614

	Nashville, Tenn.	New Haven, Conn.	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma, City, Okla.	Omaha, Neb.
Degree-days for April, 1937	217	531	28	479	251	192	458
Degree-days, Sept. 1, 1936 to Apr. 30, '37	3472	5255	1087	4748	3020	3972	6642
Degree-days, Sept. 1, 1935 to Apr. 30, '36	4092	5689	1401	5228	3616	3926	7161
Degree-days, Sept. 1 to Apr. 30, Normal	3578	5672	1024	5192	3349	3613	6047

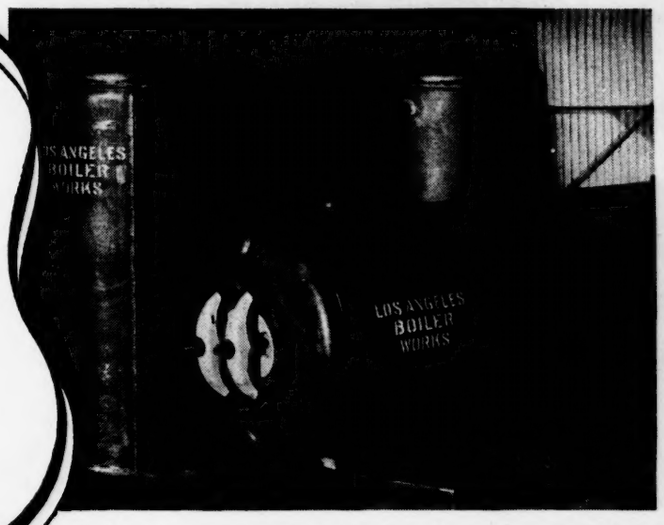
	Peoria, Ill.	Philadelphia, Pa.	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.
Degree-days for April, 1937	465	411	455	650	450	557	455
Degree-days, Sept. 1, 1936 to Apr. 30, '37	5865	4466	4887	6270	4208	5343	4849
Degree-days, Sept. 1, 1935 to Apr. 30, '36	6640	4914	5600	6647	4229	5786	5391
Degree-days, Sept. 1 to Apr. 30, Normal	5988	4787	5157	6644	4134	5763	5293

	Richmond, Va.	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.
Degree-days for April, 1937	273	604	323	521	314	548	476
Degree-days, Sept. 1, 1936 to Apr. 30, '37	3629	6091	4704	5840	2558	5730	4330
Degree-days, Sept. 1, 1935 to Apr. 30, '36	4210	6705	5315	5306	2080	6181	4239
Degree-days, Sept. 1 to Apr. 30, Normal	3725	6472	4585	5319	2418	5958	4397

	Spokane, Wash.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for April, 1937	550	586	556	453	635	355	289
Degree-days, Sept. 1, 1936 to Apr. 30, '37	6539	6026	5920	4859	2795	4136	4920
Degree-days, Sept. 1, 1935 to Apr. 30, '36	6282	6630	6648	5376	6847	4685	5016
Degree-days, Sept. 1 to Apr. 30, Normal	5989	6614	5893	4852	6543	4601	4673

To obtain unit fuel consumption figures for any city shown above, multiply the number of degree-days by the following factors: for coal, 0.008; for oil, 0.00069; for gas, 0.096. Figures obtained will show coal consumption in pounds per square foot of radiator surface; oil consumption in gallons per square foot; gas consumption in cubic feet per square foot—all for the period covered by the number of degree-days. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operation at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal; 140,000 B.t.u. per gal. for oil, and 1,000 B.t.u. per cu. ft. for gas. To correct for other heating values, efficiency and design conditions, follow the method explained in the "HEATING & VENTILATING Degree-day Handbook" or on H. & V.'s Reference Data Sheet Nos. 67 and 68. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

☆ U. S. GOVERNMENT has Non-Rust Tanks of Everdur Silicon Bronze in new Coast Guard Station at San Diego



Three 36" diameter EVERDUR tanks are now in use at the new U. S. Coast Guard Station at San Diego, Cal. They were made for Crane Co., San Diego Branch, by the Los Angeles Boiler Works to comply with U. S. Government Specification WWP-541.

U. S. Coast Guard Station, Marine Base, Lindbergh Field, San Diego, Cal.

NOTHING was spared in assuring the absolute efficiency of this splendid Coast Guard Base. For these heater shells, The American Brass Company's copper-silicon alloy, EVERDUR, assures long life... freedom from rust ...and the elimination for all time of troublesome rust-repairs and heavy replacement expense.

EVERDUR is a sturdy alloy. It combines the corrosion-resisting qualities of copper with the strength of steel. Yet its fabricating cost is relatively low, and it is readily welded by usual methods. EVERDUR storage water heaters for every purpose are obtainable from leading equipment manufacturers throughout the country.

ANACONDA

Everdur Metal

RUSTLESS AS COPPER
STRONG AS STEEL

37164

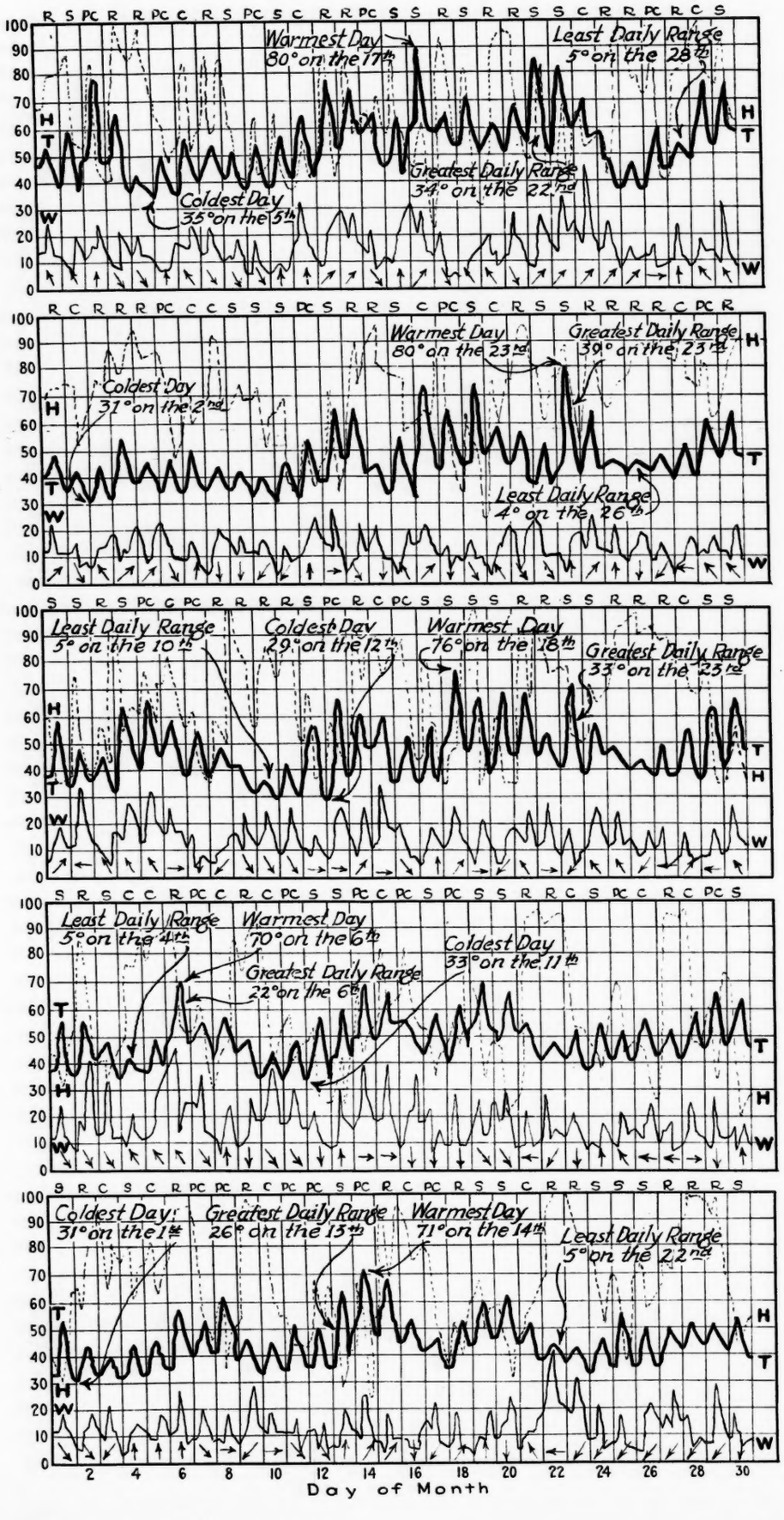
THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONNECTICUT

Offices and Agencies in Principal Cities • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

*EVERDUR is a trade-mark of The American Brass Company, registered in the United States Patent Office.

THE WEATHER FOR APRIL, 1937

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.


Warmest Day 80° on the 17th
Least Daily Range 5° on the 28th
Greatest Daily Range 34° on the 22nd
Coldest Day 35° on the 5th
Warmest Day 80° on the 23rd
Greatest Daily Range 39° on the 23rd
Coldest Day 31° on the 2nd
Least Daily Range 4° on the 26th
Least Daily Range 5° on the 10th
Coldest Day 29° on the 12th
Warmest Day 76° on the 18th
Greatest Daily Range 33° on the 23rd
Least Daily Range 5° on the 4th
Warmest Day 70° on the 6th
Greatest Daily Range 22° on the 6th
Coldest Day 33° on the 11th
Coldest Day 31° on the 1st
Greatest Daily Range 26° on the 13th
Warmest Day 71° on the 14th
Least Daily Range 5° on the 22nd
T
H
W
Day of Month

St. Louis

Mean temp. for month, 55.0F; aver. wind velocity, 13.5 m.p.h.; prevailing direction of wind, S.

Chicago

Mean temp. for month, 46.5F; aver. wind velocity, 11.2 m.p.h.; prevailing direction of wind, E.

Pittsburgh

Mean temp. for month, 47.8F; aver. wind velocity, 13.3 m.p.h.; prevailing direction of wind, NW.

New York

Mean temp. for month, 49.0F; aver. wind velocity, 15.8 m.p.h.; prevailing direction of wind, N.

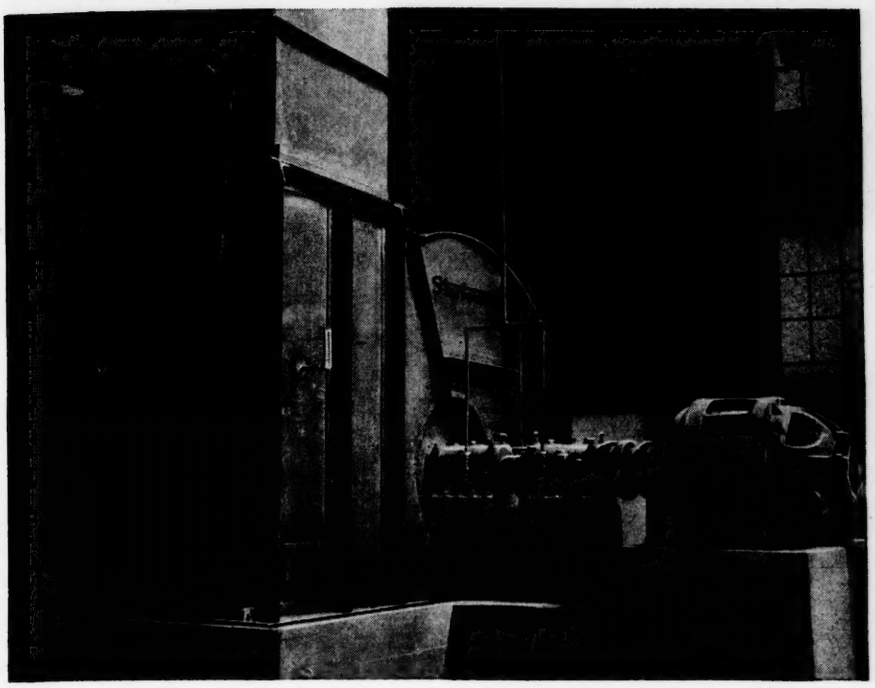
Boston

Mean temp. for month, 45.2F; aver. wind velocity, 11.7 m.p.h.; prevailing direction of wind, NW.

Sturtevant

REG. U. S. PAT. OFF.

Puts Air to Work



STURTEVANT FANS SERVE LEHIGH CEMENT MILL KILN

Sturtevant Fans were the choice for Mechanical Draft service when the Lehigh Portland Cement Co. modernized its Fordwick, Va. plant. Two 10 ft. Fans serve the Babcock and Wilcox boilers.

Hammermill Paper Co.... U. S. Rubber Co.... Celanese Corp.... Standard Oil of Calif.... Savannah Sugar Refining Co.... are merely a few of the many other recent boiler installations for which Sturtevant Draft Fans were selected.

No matter how large or small your air moving requirements may be, we can meet them exactly. Our 70 years of air engineering experience make Sturtevant the logical source for air handling or conditioning equipment of practically every kind. We invite your inquiry.

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

Sales Offices in 40 Cities. *Plants* at Hyde Park, Mass.; Framingham, Mass.; Camden, N. J.; Sturtevant, Wis.; Berkeley, Cal.; Galt, Ont. B. F. Sturtevant Co. of Canada—Galt, Toronto, Montreal

Blowers . . . Exhausters

Centrifugal and propeller types. For ventilating, fume removal, and all other purposes. Acid Resisting Fans. High Pressure Blowers.

Air Washers

Made in several types and wide range of capacities to meet varying requirements in cleaning, cooling, dehumidifying, and humidifying air.

Vacuum Cleaners

Used for removing dangerous dust and for general cleaning purposes. Assure speedy, thorough cleaning and effective disposal of dust and dirt. Portable types and central systems.

Air Conditioning

Individual units of equipment or complete central systems for maintenance of desired temperature and humidity in industrial air conditioning.

Drying Equipment

A wide variety of equipment for industrial drying in connection with textile, rubber, wood, leather, chemical, food, ceramic, and many other products.

Power Roof Ventilators

Electric motor driven. Equipped with a powerful, efficient fan wheel which does a real ventilating job. Can be built of acid-resisting metals if necessary.

Unit Heaters

In types for ceiling, wall, or floor installation. Widest and most varied range of capacities available up to 1,500,000 B.T.U.

Electric Motors

AC and DC. Fraction and integral horsepower sizes. For general purposes and special applications.

WORLD'S LARGEST MAKER OF AIR HANDLING AND CONDITIONING EQUIPMENT

WITH THE MANUFACTURERS

Air-Maze Corp., 812 Huron Rd., Cleveland, has appointed *W. G. Heacock* Michigan factory representative, with headquarters at the Barton D. Wood Co., 2832 E. Grand Blvd., Detroit. Mr. Heacock was formerly sales manager of the company.

Anthracite Industries, Inc., New York, will shortly open two new permanent exhibits; one in Boston, one in Philadelphia. With the permanent exhibit at the Architects' Samples Corp., 101 Park Ave., New York, the three major cities in the anthracite-burning area will shortly have centers to which citizens and visitors may come to inspect modern boilers, stokers, thermostats and tank heaters.

The Babcock & Wilcox Tube Co., Beaver Falls, Pa., has appointed *J. P. Boore* assistant general sales manager.

Carrier Corp., Newark, N. J., has moved its Chicago office from 180 N. Michigan Blvd. to the *Merchandise Mart.*

Century Electric Co., St Louis, Mo., has moved its New York office from 50 Church St. to larger quarters at *30 Vesey St. James Larkin* is district sales manager.

Crane Co., Chicago, has coordinated all activities concerned with the estimating, engineering, or sales of valves, fittings, pipe, and fabricated piping into one unit, the *valve and fitting department,* with *W. H. Pape* as manager. He has been associated with Crane for the past 10 years.

The former industrial sales department and engineering sales department are consolidated into a new section, the engineering sales section of the valve and fitting department, with *E. Burke* as manager. *G. F. Wright* is assistant manager in charge of estimating and other activities dealing with fabricated pipe and allied products; *W. F. Lahl,* assistant manager supervising industrial zone men in the field, and *J. H. Barker* manager of the sales quotation section of the valve and fitting department.

The Emerson Electric Mfg. Co., St. Louis, Mo., has established a new field service station policy. Forty-one firms have been appointed authorized company service stations for their respective territories and will handle all repairs on motors A list of these names and addresses will be furnished by Emerson Electric upon request for Data Sheet X2042.

Frick Co., Waynesboro, Pa., has moved its Pittsburgh branch office from 1005 Liberty Ave. to *606 Empire Building. P. A. Willis* is branch manager.

Frigidaire Division, General Motors Corp., Dayton, Ohio, will start within the next few weeks erection of two new factory buildings together with enlargement and rearrangement of the Moraine City, Ohio, plant. The construction and plant layout program will involve an expenditure in excess of $4 million and will be the largest expansion of Frigidaire since the building of the present plant in 1926.

General Refractories Co., Philadelphia, Pa., has elected *S. M. D. Clapper,* former president, as chairman of the board. *Floyd L. Greene,* former executive vice-president, was elected president.

NO FIRE HAZARD HERE!

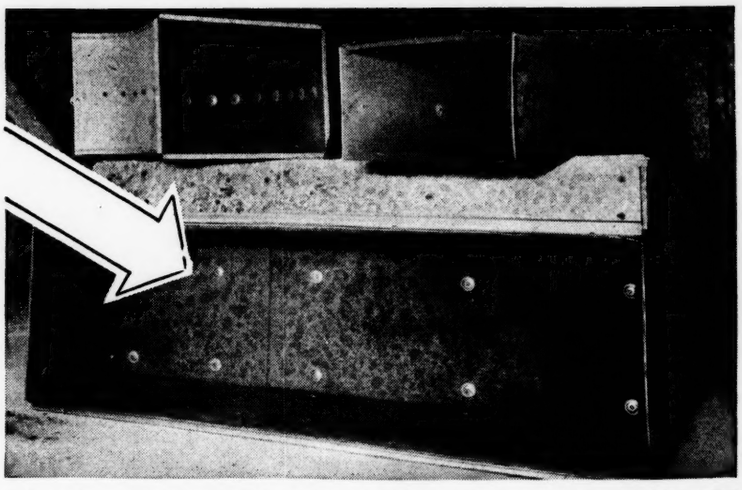
SERIOUS LOSSES have been reported in buildings where combustible sound absorbents—used to line air-conditioning ducts—have caught fire*.

The use of Johns-Manville Airacoustic Sheets for duct lining permanently eliminates this costly, unnecessary threat. Not only do these sheets provide as high as 80% sound absorption —but also, *they cannot burn or smolder. Can never contribute to fire spread.*

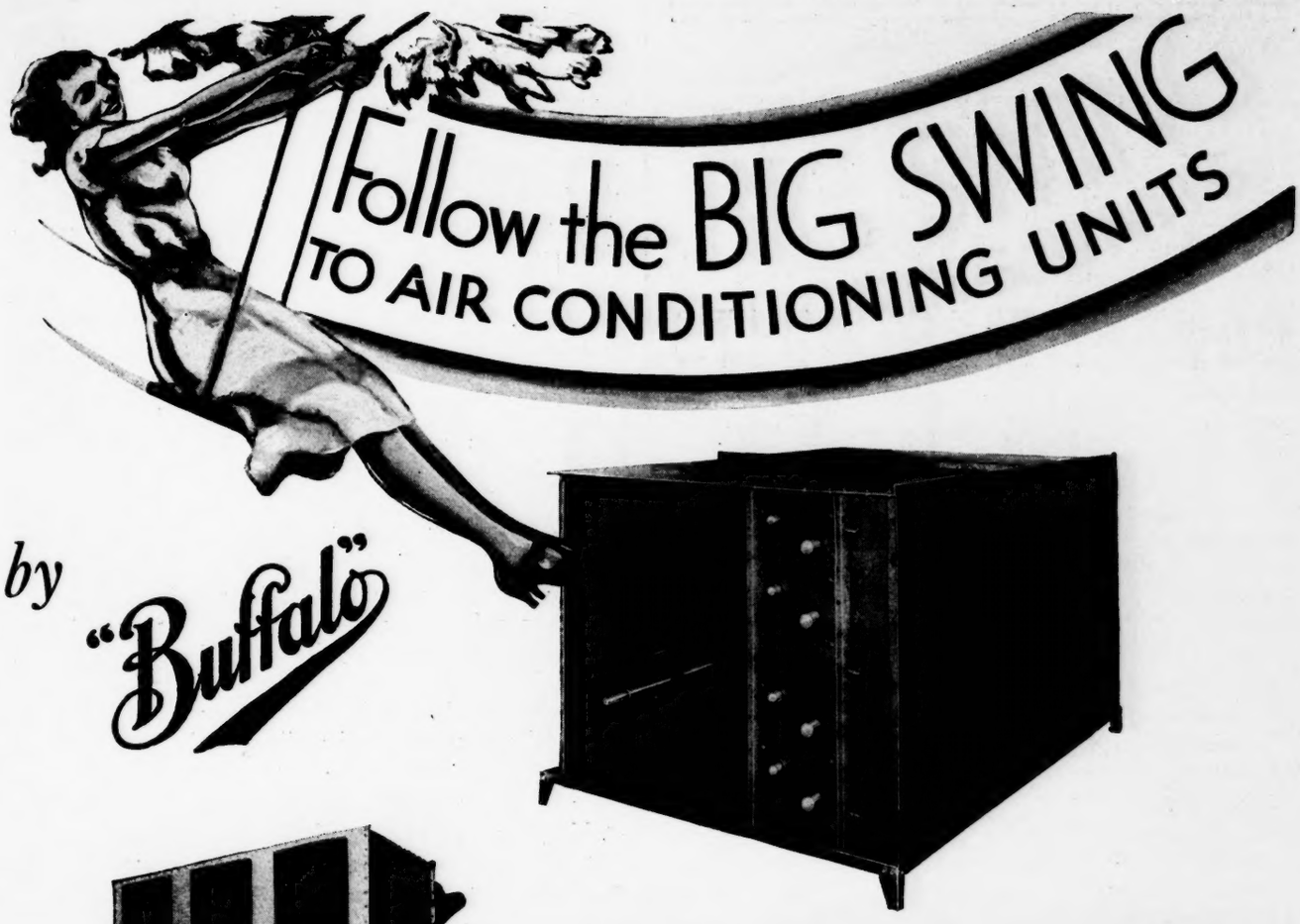
Furthermore, J-M Airacoustic Sheets are mineral in character . . . hence, permanent. Highly resistant to moisture . . . a serious enemy to the life of any material used in air-conditioning equipment. Light in weight, they are easily handled, quickly applied. Thermal conductivity is low; transverse strength high. And being smooth-surfaced—Airacoustic Sheets have a low frictional resistance.

For complete data on J-M Airacoustic Sheets, write Johns-Manville, 22 East 40th Street, New York City.

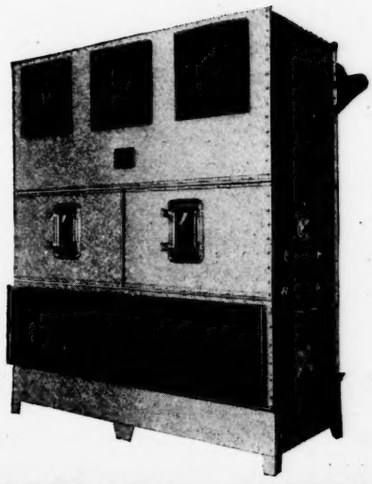
*** In our files are bulletins from The National Board of Fire Underwriters, reporting several cases of this very nature.**



JM Johns-Manville
AIR ACOUSTIC SHEETS FOR DUCT LINING



by "Buffalo"



EVAPORATIVE CONDENSERS

If you are interested in reaching a "new low" in condenser cooling costs, then be sure to send for a copy of our new bulletin on our "ECC" Evaporative Condensers.

"Buffalo" Evaporative Condensers will save over 90% of the water used for direct cooling of condensers.

The make-up water required will not exceed .03 G.P.M. per ton of refrigeration. The necessity for cooling towers is eliminated, thus saving a large amount of space.

These evaporative condensers are designed for high efficiency with large coil surfaces, low air velocities and consequent low power consumption.

"PC" Central Conditioning Cabinets—*Capacity 3 Tons up*

Whatever your air conditioning problem—simple or complex, large or small, mere cooling or complete air conditioning—heating, humidifying, dehumidifying, and year 'round cleaning, you can solve that problem more efficiently, more economically and for many years to come if you install "Buffalo" "PC" Central Conditioning Cabinets.

The last word in simplicity of design and quiet operation because they have been built by an organization representing many "life-times" of study and research in air conditioning equipment throughout the world.

We have just completed a 32 page bulletin telling the whole story of "Buffalo" "PC" Cabinets. We shall gladly send you a copy on request.

"See Your Consulting Engineer."

BUFFALO FORGE COMPANY

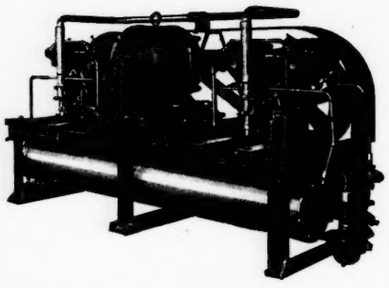
480 BROADWAY • BUFFALO, N. Y.

Branch Engineering Offices in Principal Cities

In Canada: CANADIAN BLOWER & FORGE CO., LTD., Kitchener Ont.

Performance Proves the Quality of

CURTIS CONDENSING UNITS



● Day after day, in thousands of air conditioning and refrigeration installations, the superior quality of Curtis design and construction is being proven beyond a doubt. Dependable, efficient, care-free performance is a characteristic of every one of the 86 Curtis Units, from 1/6 H P to 30 H P, air and water cooled.

Curtis quality is the result of 83 years of experience, of advanced engineering and precision manufacturing with 43 years specializing in building fine compressors.

Curtis engineering created the patented "Centro-Ring" method of positive pressure lubrication with no wearing parts. Curtis designing includes Timken Tapered Roller Main Bearings, water jacketed compressor heads and cylinders, drop forged heat-treated crankshafts and rods, balanced sylphon bellows seal, built-in oil separator with automatic return and automatic water valves, and precision manufacture throughout.

There's a Curtis condensing unit for every air conditioning and refrigeration need. Curtis quality guarantees superior performance.

CURTIS REFRIGERATING MACHINE CO.

Division of Curtis Manufacturing Company
1958 Kienlen Avenue, Saint Louis, Missouri

In Canada:
Canadian Curtis Refrigeration Company, Ltd.
20 George Street, Hamilton, Ontario, Canada

CURTIS

General Refrigeration Sales Co., Beloit, Wis., has opened a Chicago branch office and showroom at *415 N. La Salle St.*

Hart & Cooley Manufacturing Co., Chicago, has added 15,000 sq. ft. to its Holland, Mich., plant. This is the second major enlargement to the Holland plant undertaken by the company within the last six months, the first having been completed late last fall. The additional floor space will be used for the production of the company's bar-type forced air registers.

The Herman Nelson Corp., Moline, Ill., has added 10,000 sq. ft. to the manufacturing facilities of its main factory. General offices of the corporation are also being remodeled to accommodate an increase in personnel.

Independent Air Filter Co., Chicago, has moved its general offices to the Builders Building, *228 N. La Salle St.* More manufacturing floor space has also been leased on the north side of Chicago.

The Mercoid Corp., Chicago has transferred *William Ufer* and *Walter Lischett* to its sales department after a long training period spent in the factory and as service men for several years. *R. M. Keatts* and *J. F. McCauley* were also transferred to the sales organization, Mr. Keatts to work out of the Cincinnati office and Mr. McCauley in the Cleveland area. *J. F. Chambliss* was appointed auditor of the corporation.

The Permutit Co., New York, has named *Mark D. Rowe* as manager of domestic sales to succeed Oliver P. Harris, who recently resigned.

Randall Graphite Products Corp., 609-13 W. Lake St., Chicago, has appointed *M. E. Clark* sales manager. Mr. Clark was recently associated with Drying Systems as assistant engineer in charge of air conditioning.

Ward Leonard Electric Co., Mount Vernon, N. Y., has appointed *J. Y. Dahlstrand* special representative for the sale of its automatic voltage regulators. His headquarters are at *1719 South St.*. Burlington, Iowa.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has become a general licensee under *Auditorium* patents and is authorized to install, or grant permission to others to install, central station air conditioning systems embodying Auditorium inventions. It also has the right to manufacture and sell unit conditioners utilizing these same patents.

Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa., has named *S. D. Mahan* general advertising manager. Formerly manager of merchandising advertising, Mr. Mahan will now have general supervision over all advertising and sales promotion work of the company and its subsidiaries.

Yarnall-Waring Co., Chestnut Hill, Philadelphia, has named *Henry H. Seabrook, Jr.*, assistant to H. J. Heineman, Pittsburgh sales representative. *Fred Wetherill* has been appointed sales engineer in the impulse steam trap division. The Company is completing an 80 x 80 ft. extension to its Philadelphia plant.

Yarnall-Waring Co., Chestnut Hill, Philadelphia, has named *J. S. Fanning* assistant to Roger A. Martin, Atlanta sales representative.

York Ice Machinery Corp., York, Pa., has appointed *S. L. Cordis* branch manager of its Seattle, Wash., office.

NEW CATALOGS

(Unless otherwise indicated the publishers of catalogs will supply copies on request without charge.)

American Radiator Co., 40 W. 40th St., New York. A six-page, standard-size bulletin describing Ideal boilers for oil burning. Includes information on ratings and data. Lists transmission rates, heating surface, firebox dimensions, and chimney sizes of 12 different Arco boilers.

The Brown Instrument Co., Wayne and Roberts Ave., Philadelphia, Pa., has published a new catalog, No. 3005, on the Brown CO_2 meters. Catalog covers the line of Brown indicating and recording CO_2 units as well as the combined CO_2 flue gas temperature recorders. Included in the catalog is a schematic diagram which illustrates the operating principle of the CO_2 unit and describes the CO_2 flue gas temperature to the various units.

Henry Valve Co., 1001 N. Spaulding Ave., Chicago. A standard-size, eight-page catalog, No. 62, describing the Henry line of strainers, scale traps, filters, dryers and shut-off and relief valves and service tools for refrigeration and air conditioning. Gives dimensions, list prices, and capacities.

Janette Manufacturing Co., 556 W. Monroe St., Chicago, has published a standard-size, four-page bulletin, No. 24-2, on Janette blower wheels. Lists advantages, construction features, and sizes available.

Nash Engineering Co., South Norwalk, Conn. A standard-size, eight-page bulletin, No. 264, describing the Jennings manifold vacuum heating pump. This pump is designed for installation on return line vacuum heating systems or with any service where a liquid and gas are handled together. Catalog describes the outstanding features of the pump and gives ratings, capacities, power requirements, and dimensions.

Pierce Butler Radiator Corp., 701 Nichols Ave., Syracuse, N. Y. A four-page bulletin on the Pierce Eastwood oil boiler which was recently placed on the market. Discusses the advantages, features of construction, and gives dimensions and capacities.

Republic Steel Corp., Cleveland, Ohio. A standard-size, 20-page booklet entitled "The Path to Sheet Metal Permanence." Gives information on rust resistance, forming and welding properties, as well as data on physical properties and constants, forms, finishes, sizes and gages of sheet metal.

Rochester Circulator Corp., Rochester, N. Y. A standard-size, four-page mimeographed release on remodeling gravity hot water heating systems with Rochester circulators. Describes how the Rochester circulator can be applied to various types of gravity hot water heating systems.

H. A. Thrush & Co., Peru, Ind., has published an attractive, standard-size bulletin, FC-437, which describes the Thrush flow control system. Included in the bulletin are descriptions of the Thrush hot water heating system, flow control valve, water circulator and the radiant heat control.

Now an...

AUDITORIUM LICENSEE

Westinghouse—one of the world's greatest engineering organizations—joins with the other notable concerns listed below, as Licensees under Auditorium Patents. Westinghouse Electric & Manufacturing Company is authorized to install, or grant permission to others to install, Central Station Air Conditioning Systems embodying Auditorium inventions. It also has the right to manufacture and sell Unit Conditioners utilizing these same patents.

AMERICAN BLOWER CORPORATION—Detroit, Mich.
BUFFALO FORGE COMPANY—Buffalo, New York
CARRIER CORPORATION—Newark, New Jersey
FRICK COMPANY—Waynesboro, Pa.
GENERAL ELECTRIC COMPANY—Schenectady, N. Y.
J. O. ROSS ENGINEERING CORP.—New York, N. Y.
THE COOLING & AIR CONDITIONING CORP.
(Division of B. F. Sturtevant Co.)
Hyde Park, Boston, Mass.
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY—East Pittsburgh, Pa.
YORK ICE MACHINERY CORPORATION—York, Pa.

Any of the Licensees above, their Branch Offices, Distributors, or Dealers can furnish information and diagrams describing Auditorium Systems. For details of the Auditorium Plan you may write direct to

AUDITORIUM CONDITIONING CORPORATION
New York Office — 17 East 42nd St., New York

52 BUILDING OWNERS SAVE $12,187.98 IN FEBRUARY 1937

Webster Heating Modernization Saves Average of $234 per Building in Short Month

NO "STARVING" TO GET RESULTS

Owners Report on Effectiveness of Webster Moderator and Hylo Systems

MEETS DIVERSE HEATING NEEDS

Camden, N. J.—Fifty-two buildings heated by Webster Systems of Steam Heating reported reductions in heating costs of $12,187.98 during February, 1937, an average saving of $234.19 for this short month.

These savings facts are based on heating results in 52 buildings for which figures were readily available—buildings representative of the hundreds heated by Webster Moderator and Hylo Systems of Steam Heating. Following are the actual fuel savings:

10,222....gallons of fuel oil

597.91....tons of coal

14,038,168....lbs. of steam

Economy is seldom the main objective of a Webster Heating Modernization Program. Included among the buildings reporting substantial February savings are hotels and apartment houses where perfect heating comfort for guests comes before any consideration of cost; department stores where an increase in heating expense is a wise investment if it makes the store more comfortable for customers; office buildings where heating satisfaction is an important factor in building occupancy; industrial plants, medical buildings, educational institutions, all with heating needs more important than economy.

In these 52 buildings, regardless of the heating method used—oil, coal or purchased steam—and regardless of the heating problems involved, Webster Systems provided perfectly balanced heating service during the severest weather. There is no "starving" of the systems to get results. Steam savings represent an extra advantage after the heating problem in each building has been solved.

Webster Central Controls are of the throttling type, delivering less heat in mild weather. There is no intermittent heating—no so-called "cold 70" or overheating resulting from an off-and-on control.

If you are interested in heating *new* buildings, or in improved heating service and lower heating cost in your present building address

WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating
Representatives in 60 principal U.S. Cities — Est. 1888

YARNALL-WARING Co., Chestnut Hill, Philadelphia, Pa., has published a four-page, standard-size bulletin No. N-615, on the Yarway spray nozzles for air conditioning and general industrial uses. Bulletin describes the Yarway involute design with cooling nozzles and atomizing nozzles. Gives dimensions and operating data.

COMING EVENTS

JUNE 1-4, 1937. Annual Meeting, American Institute of Architects, Hotel Somerset, Boston, Mass.

JUNE 1-4, 1937. Annual Meeting, Edison Electric Institute, Palmer House, Chicago, Ill.

JUNE 4-5, 1937. Meeting, Stoker Manufacturers Association, White Sulphur Springs, W. Va.

JUNE 7-11, 1937. Annual Convention, American Retail Coal Association. 1937 Exposition of the Solid Fuel Industry, Palmer House, Chicago.

JUNE 9-10, 1937. Mid-Year Convention, National Warm Air Heating and Air Conditioning Association, Hotel Cleveland, Cleveland, O.

JUNE 18-JULY 10, 1937. Intensive Course in Refrigeration, Purdue University, Lafayette, Ind. Prof. G. A. Young, Head, School of Mechanical Engineering.

JUNE 21-24, 1937. 31st Annual Meeting, American Society of Agricultural Engineers, Urbana-Lincoln Hotel. Urbana, Ill. Registration Headquarters, Women's Building, University of Illinois.

JUNE 21-24, 1937. National Convention and Exhibit, National Association of Building Owners and Managers, Statler Hotel, Buffalo, N. Y.

JUNE 23-26, 1937. Semi-Annual Meeting, American Society of Heating and Ventilating Engineers, New Ocean Hotel, Swampscott, Mass.

JUNE 28-JULY 2, 1937. 40th Annual Meeting and 4th Exhibit of Testing Apparatus, American Society for Testing Materials, The Waldorf-Astoria, New York.

JULY 12-31, 1937. Intensive Course in Air Conditioning, Purdue University, Lafayette, Ind. Prof. G. A. Young, Head, School of Mechanical Engineering.

AUGUST 3-7, 1937. Power Show and Mechanical Exposition, The Universal Craftsmen Council of Engineers of the World, Hotel Stevens, Chicago.

AUGUST 30-SEPTEMBER 3, 1937. National Convention, National Association of Power Engineers, Inc., Jefferson Hotel, St. Louis, Mo.

SEPTEMBER 27-OCTOBER 1, 1937. 19th Annual Convention, American Gas Association, Hotel Cleveland, Cleveland, Ohio.

OCTOBER 4-9, 1937. Chicago Exposition of Power and Mechanical Engineering, International Amphitheater, Chicago. Charles F. Roth, Grand Central Palace, New York.

OCTOBER 5-8, 1937. 66th Annual Meeting, American Public Health Association, Hotel Pennsylvania, New York.

OCTOBER 18-22, 1937. 18th Annual Meeting, American Welding Society, Hotel Traymore, Atlantic City, N. J.

OCTOBER 18-22, 1937. National Metal Exposition (including Welding) Convention Hall, Atlantic City, N. J. W. H. Eisenman, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 9-12, 1937. 18th Annual Meeting, American Petroleum Institute, Stevens Hotel, Chicago.

DECEMBER 6-11, 1937. 16th Exposition of Chemical Industries, Grand Central Palace. New York.

JANUARY 24-28, 1938. 5th International Heating and Ventilating Exposition, Grand Central Palace, New York. Charles F. Roth, Grand Central Palace, New York.

JANUARY 24-28, 1938. 44th Annual Meeting, American Society of Heating and Ventilating Engineers, New York.

DECEMBER 5-10, 1938. 13th National Exposition of Power and Mechanical Engineering, Grand Central Palace New York.